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8-6-21

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Seat Belt Assemblies

(Docket No. 80-12; Notice 2)

ACTION: Final rule.

SUMMARY: This notice amends Safety Standard No. 209, *Seat Belt Assemblies,* to exempt seat belts installed in conjunction with automatic restraint systems from the belt elongation requirements of the standard. This amendment is based on a petition for rulemaking submitted by Mercedes-Benz of North America and follows the publication of a proposal. The amendment permits manufacturers to install belt systems incorporating load-limiting devices which are intended to make further reductions in head and upper torso injuries during an accident. Some load-limiting belt systems utilize webbing that elongates more than is currently allowed by Standard No. 209. This amendment would permit this and other type systems to exceed the maximum elongation allowed by the standard.

DATES: This amendment is effective January 12, 1981.

ADDRESSES: Any petition for reconsideration should refer to the docket number and notice number and be submitted to: National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

FOR FURTHER INFORMATION CONTACT: Mr. William Smith, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, Washington, D.C. 20590 (202-426-2264).

SUPPLEMENTARY INFORMATION: Safety Standard No. 209, *Seat Belt Assemblies* (49 CFR 571.209), specifies performance requirements for seat belts to be used in motor vehicles. One of these performance requirements specifies the maximum amount that the webbing of a belt assembly is permitted to extend or elongate when subjected to certain specified forces (paragraph S4.2(c)). Mercedes-Benz of North America petitioned NHTSA to exempt seat belt assemblies installed in passenger cars in conjunction with air cushion restraint systems from the webbing elongation requirements of the standard. The agency granted that petition and issued a notice of proposed rulemaking to amend the standard on August 4, 1980 (45 F.R. 51626).

Mercedes is considering the use of a belt system that incorporates a load-limiting device. A load-limiter is a seat belt assembly component or feature that controls tension on the seat belt and modulates or limits the force loads that are imparted to a restrained vehicle occupant by the belt assembly during a crash. Load-limiting devices are intended to reduce head and upper torso injuries through increased energy management. A load-limiter can be a separate component of the seat belt system, such as a torsion bar that allows the retractor to reel out additional webbing when a certain designed force level is reached. The load-limiter can also be a feature of the webbing itself, such as webbing that will elongate to certain designed lengths when subjected to particular force levels. Mercedes is interested in using the latter type load-limiting system. However, the webbing in the Mercedes belt system would elongate beyond the limits that are currently specified in Standard No. 209. Mercedes' petition stated that this type belt system should be allowed in vehicles equipped with air cushion restraints since the two systems used in conjunction with one another can be designed to achieve the maximum reduction in head injuries and upper-torso injuries.

Although safety belts protect occupants from life-threatening impacts with the vehicle interior, the forces necessarily generated by the belts upon occupants during a crash can result in upper torso injury. As noted in the notice of proposed rulemaking, data available to the agency indicate that load-limiting belts can reduce these injuries, as well as working in combination with an automatic restraint system to provide protection for impacts with the vehicle interior. The proposal specified that both Type 1 (lap belts) and Type 2 (combination lap and shoulder belts) manual belts having load-limiting devices and used in conjunction with automatic restraints would be exempted from the elongation requirements. Additionally, the proposal specified that such belts would have to be labeled to clarify that they are intended for use only in vehicles equipped with automatic restraint systems.

The proposal limited the use of load-limiting belts to vehicles equipped with automatic restraints since there are currently no dynamic performance requirements or injury criteria for manual belt systems used alone. There are no requirements to ensure that a load-limiting belt system would protect vehicle occupants from impacting the steering wheel, instrument panel and windshield, which would be very likely if the belts elongated beyond the limits specified in Standard No. 209. Therefore, the elongation requirements are necessary to ensure that manual belts used as the sole restraint system will adequately restrain vehicle occupants.

Nine comments were submitted in response to the August 4 proposal, all supporting the exemption for load-limiting belts. Vehicle manufacturers stated that the proposed exemption from the elongation requirements would allow design flexibility and lead to improved occupant restraint systems.

American Motors Corporation (AMC) stated that the exemption for load-limiting belts should only apply to Type 2 manual belts. The company argued that the only available data relates to the ability of Type 2 load-limiting belts to reduce certain head and upper-torso injuries. AMC stated that torso injury is not a function of lap belt loads and that no similar correlation has been made between lap belt loads and pelvic fractures. Therefore, the company believes that the exemption from the elongation requirements for Type 1 belts should be postponed until specific injury patterns can be correlated with lap belt loads.

The agency proposed allowing the exemption for both Type 1 and Type 2 belts in order to give manufacturers broader design latitude to use load-limiting features on all belt systems used in conjunction with automatic restraints. AMC is correct in its statement that more data are available regarding the correlation between Type 2 belts and upper-torso injury than is available regarding load-limiting features on Type 1 belts. However, comments received from Rolls-Royce Motors stated that the company has tested manual Type 1 belts incorporating load-limiting features and found that better results are obtained under the injury criteria of Safety Standard No. 208 (49 CFR 571.208) than with Type 1 belts which must comply with the elongation requirements. In light of this information, and the fact that load-limiting Type 1 belts would only be allowed in conjunction with automatic restraint systems complying with the injury criteria of Standard No. 208, the agency has decided to include Type 1 belts in the exemption. This will allow manufacturers to develop innovative designs to maximize the protection provided by its automatic restraint systems. If future data indicate a problem with Type 1 belts that incorporate load-limiting features, the exemption from the elongation requirements can be reconsidered by the agency.

The August 4, 1980, notice proposed to add a new definition to Standard No. 209 to define "load-limiter," and limited the exemption from the elongation requirements to belts incorporating load-limiters and installed in conjunction with automatic restraints. Volvo of America Corporation commented that the definition of "load-limiter" is very broad and could be interpreted to include all existing belt webbing. Volvo stated that the exemption should, therefore, apply to any Type 1 or 2 belt installed in conjunction with an automatic restraint, and not be limited to load-limiting belts.

While the agency understands Volvo's point that the proposed language may be extremely detailed, we believe the language is necessary to clarify the exemption and to avoid confusion for belt manufacturers. Safety Standard No. 209 is an equipment standard rather than a vehicle standard, and each

seat belt assembly must be certified by the belt manufacturer. The proposed language was intended to create a clear distinction between belts complying with elongation requirements of Safety Standard No. 209 and those that incorporate load-limiting features that preclude compliance with the elongation requirements. The proposed language explained which belt systems must be labeled as being for use only in vehicles equipped with automatic restraints. The agency believes this language, including the definition of "load-limiter," is necessary at the current time to clarify the requirements for those persons or manufacturers who may not be totally familiar with the requirements of Safety Standard No. 209. Otherwise, it would not be clear from the standard why certain belts are exempted from the elongation requirements of the standard.

In another comment related to this same subject, General Motors Corporation pointed out that the proposed labeling requirement for load-limiting belts could apply to all Type 1 and 2 belts incorporating load-limiting features even if all current 209 requirements are met. General Motors stated that load-limiting belt systems that can, nevertheless, comply with the elongation requirements of the standard should not be limited in their application to vehicles equipped with automatic restraint systems. The agency agrees with this argument, and the language is changed in this amendment accordingly.

General Motors also questioned the need to require any label at all on load-limiting belts. The proposal specified that such belts would have to be permanently marked or labeled to indicate the assembly may only be installed in vehicles in conjunction with an automatic restraint system. General Motors argued that a label is not necessary to control the installation of load-limiting belts in the proper vehicles. Seat belt manufacturers must currently provide appropriate installation instructions for its equipment. General Motors contends that this requirement, coupled with the fact that replacement belts are generally ordered and installed by a repair facility, will ensure that load-limiting belts are only installed in vehicles equipped with automatic restraints. The agency does not agree with this position. As stated earlier, the agency believes that care must be taken to distinguish load-limiting belt systems from other systems. If there is a label on the belt itself, a person making the installation will be aware that the belt should only be installed in conjunction with automatic restraints. This should be made obvious to the person making the installation without reference to the installation instructions. Further, none of the other commenters objected to the proposed labeling requirement. American Motors Corporation specifically stated that a label is necessary.

General Motors is correct in its statement that this warning will also be provided in the installation instructions provided by the belt manufacturer. Paragraphs S4.1(1) of Safety Standard No. 209 provides, in part, that the installation instruction sheet provided by the belt manufacturer shall state whether the assembly is for universal installation or for installation only in specifically stated motor vehicles. Therefore, belt manufacturers will be required to specify in the installation instructions that load-limiting belts are only to be installed in combination with automatic restraint systems. The agency believes that at the current time these duplicative warnings, in the instruction sheet and on a belt label, are a necessary precaution to ensure that load-limiting belts are only installed in the proper vehicles. After a majority of vehicles on the road are equipped with automatic restraints, such labeling may no longer be necessary.

Volvo of America Corporation commented that some upper limit on belt elongation may be required for Type 1 manual belts incorporating load-limiting features, although no such limit was specified in the proposal. Volvo pointed out that Type 1 belts installed in conjunction with air cushion restraints will also provide roll-over protection for vehicle occupants. The company is concerned that if no upper limit on elongation is specified, such belts may not provide the intended protection in roll-over accidents.

While the agency agrees that this is a legitimate concern, it does not believe it is necessary to specify such an upper limit at the current time. It is not likely that manufacturers will design load-limiting belt systems that will elongate appreciably beyond the limits specified in Standard No. 209. Presumably, load-limiting belts will be designed to provide actual restraint in conjunction with the automatic restraint system, if the vehicle is to comply with the injury criteria of Safety Standard No.

208. If a load-limiting belt design elongates to the extent that it would provide no protection in roll-over accidents, it would also not provide any protection in frontal crashes. Therefore, it is not likely that manufacturers would permit such extensive elongation in their systems. Moreover, the forces generated in frontal crashes are more severe than those that occur in roll-over accidents, so the elongation that would occur even with load-limiting systems would not be as great in roll-over accidents as in frontal accidents. The agency believes that manufacturers should be given broad latitude in the development of load-limiting belt systems to be used in vehicles equipped with automatic restraints. In light of these considerations, no upper limit on belt elongation is specified in this amendment. Manufacturers should be cognizant of the point made by Volvo, however, during the development of their systems.

The comments of Renault USA included general questions regarding automatic seat belts and the relationship between Safety Standard No. 208 and Safety Standard No. 209. Some confusion apparently exists regarding paragraph S4.5.3.4 of Safety Standard No. 208 and agency interpretations regarding that paragraph. The agency has stated in the past that only automatic belts that are installed to meet the frontal crash protection requirements of S5.1 of Standard No. 208 are exempted from the requirements of Standard No. 209. Yet, the agency has also stated that those portions of Standard No. 209 relating to retractors are applicable to all automatic belts. Renault finds these statements inconsistent.

Paragraph S4.5.3.4 of Standard No. 208 is a general provision which exempts certain automatic belts, those meeting the injury criteria of the standard, from the requirements of Standard No. 209. However, paragraph S4.5.3.3(a) of Standard No. 208 specifically provides that automatic belts shall conform to S7.1 of Standard No. 208, and that paragraph relates to the performance requirements for belt retractors specified in Standard No. 209. It is for this reason that the agency has stated that all automatic belts must comply with the retractor requirements, notwithstanding the general exemption specified in S4.5.3.4.

Renault contends that paragraph S4.5.3.4 is also inconsistent by its own terms since, Renault states, an automatic belt system must always comply with the injury criteria of S5.1 of Standard No. 208. This incorrect Paragraph S4.5.3 of Safety Standard No. 208 specifies that an automatic belt may be used to meet the crash protection requirements of any option under S4 and in place of any seat belt assembly otherwise required by that option. Therefore, prior to the effective date of the automatic restraint requirements of the standard, automatic belts could be used to satisfy the third option of section S4—the seat belt option. Automatic belts installed under the third option would not be required to comply with the injury criteria of S5.1, since the injury criteria is only specified as a requirement under option 1 and option 2. Manufacturers are permitted, however, to install automatic belts in satisfaction of either option 1 or option 2 and to certify to the injury criteria, if they desire. In summary, automatic belts installed in passenger cars in compliance with the injury criteria of Safety Standard No. 208 are only required to comply with the provisions of Safety Standard No. 209 relating to retractors. They are not required to comply with any other provision in Standard No. 209. Automatic belts installed in passenger cars that are not certified as being in compliance with the injury criteria of Standard No. 208, i.e., those installed under the third option of the standard, are required to comply with all provisions of Standard No. 209. Manual seat belts having load-limiters, installed in vehicles in conjunction with automatic restraints meeting the injury criteria of Standard No. 208, are required to comply with all provisions of Standard No. 209 except the elongation requirements (by this amendment).

The agency has determined that this amendment is not a significant regulation under Executive Order 12221, "Improving Government Regulations," and the Departmental guidelines implementing that Order. Therefore, a regulatory analysis is not required. The exemption specified in this amendment provides manufacturers with broader design alternatives and should have little if any economic or environmental impact. Consequently, the agency has also determined that a regulatory evaluation is not required.

The engineer and lawyer primarily responsible for the development of this rule are William Smith and Hugh Oates, respectively.

Issued on January 5, 1981.

Joan Claybrook
Administrator
46 F.R. 2618
January 12, 1981

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Federal Motor Vehicle Safety Standards; Seat Belt Assemblies

[Docket No. 82-15; Notice 2]

ACTION: Final rule.

SUMMARY: The purpose of this notice is to amend Safety Standard No. 209, *Seat Belt Assemblies,* which incorporates by reference a number of recommended practices and test procedures developed by voluntary standards organizations. This amendment updates those references by incorporating the most recent version of the recommended practices and procedures. This amendment is intended to keep the standard in pace with the technological changes and improvements in the industry.

DATE: This amendment is effective July 30, 1983.

SUPPLEMENTARY INFORMATION: Federal Motor Vehicle Safety Standard No. 209, *Seat Belt Assemblies* (49 CFR 571.209), specifies performance requirements for seat belts used in passenger cars, trucks, buses and multipurpose passenger vehicles (both as original and after-market equipment). Several of the performance requirements of the standard incorporate recommended practices developed by voluntary standards organizations and associations. In addition, the standard specifies that certain, long-established industry test procedures be used in determining whether the seat belts meet those performance requirements. Because of the lengthy and technical nature of the recommended practices and test procedures, the standard incorporates those specifications by reference rather than setting out full texts in Standard No. 209.

Since Standard No. 209 was first issued, along with the incorporated material, some of the referenced practices and procedures have been modified in some respects by the standards organizations, because of technological changes and advancements. In light of these modifications, the agency conducted a review of all the materials incorporated by reference within Standard No. 209 to determine which materials needed to be changed so that their most recent version is incorporated in the standard. That review led to the issuance of a proposal to amend the standard to update all materials incorporated by reference (47 FR 31712, July 22, 1982). Interested persons should consult that notice of proposed rulemaking which sets out in detail the specific sections of the standard that include incorporated material, along with the proposed updated version of that material. As noted in the proposal, the incorporated material was developed by such voluntary standards associations as the American Association of Textile Chemists and Colorists (AATCC), the American Society for Testing and Materials (ASTM) and the Society of Automotive Engineers (SAE).

Nine comments were submitted to the agency in response to the notice of proposed rulemaking, all of which supported the proposed update of materials incorporated by reference in the standard. There were only a few recommended changes in the proposed revisions.

In addition to incorporating the new ASTM corrosion resistance test procedure (paragraph S5.2(a) of the standard), the agency proposed a minor change in the procedure. The ASTM procedure specifies that the seat belt hardware is to be "suitably cleaned" prior to testing. To clarify the extent of cleaning necessary, the agency proposed to specify that any temporary coating placed on the seat belt hardware shall be removed prior to

testing. The purpose of the proposed change was to prevent the use of a coating material on the hardware during the corrosion resistance test that would aid the hardware in meeting the requirement, but which would not be found on the hardware when it is in actual vehicle use. Coatings which are applied permanently to the hardware would not have to be removed. The language proposed was as follows:

"Any surface coating or material not intended for permanent retention on the metal parts during service life shall be removed prior to preparation of the test specimen for testing."

Both Ford Motor Company and the Motor Vehicle Manufacturers Association requested changes in this language. Ford argued that the phrases "intended for permanent retention" and "during service life" are unduly restrictive because some anticorrosion coatings are applied to component parts to inhibit their corrosion during shipment to assembly plants and are intended to remain on those parts after assembly of the vehicle and its delivery to the first retail purchaser. Ford noted that such oil coatings may, however, disappear (e.g., dry up) during the service life of the vehicle. (MVMA's concern appeared to be identical to Ford's.)

The agency proposed to clarify the cleaning instructions in the corrosion test procedure because a testing laboratory brought a potential problem to the agency's attention. The laboratory reported that certain seat belt components had been delivered to it for corrosion testing which had been coated with wax. Obviously, such a coating would preclude a true testing of the components' corrosion resistance and the coating would not likely be present throughout the service life of the vehicle (and might in fact be removed during vehicle assembly). While the agency understands the point raised by Ford and MVMA (that oil coatings are intended to remain on the components upon delivery), as Ford pointed out, these coatings will likely dry up during the service life of the vehicle. Therefore, it is the agency's opinion that wax, oil or other coatings that are not permanent should be removed prior to testing since they can skew the test results and misrepresent the corrosion resistance of component parts during actual vehicle use. Consequently, the proposed language is being maintained in this amendment. It should be noted, however, that this test requirement is in no way intended to preclude manufacturers from placing any coatings, either temporary or permanent, on their seat belt assembly components.

Section S5.1(e) of Standard No. 209 specifies the test procedures for measuring the resistance to light of seat belt assemblies. In May 1980, the agency proposed to alter the test apparatus used for these requirements in light of new dacron materials being used in belt assemblies (45 FR 29102). As a part of that action, the agency proposed to update the one ASTM recommended practice (E42-64) already incorporated in the standard and to add a reference to another ASTM practice (G24-66). The proposal preceding this amendment noted that the agency is awaiting the completion of additional testing before taking final action on the May 1980 proposal and that, if an amendment were adopted, the agency would incorporate the most recent version of both the ASTM recommended practices.

Volkswagen of America pointed out that ASTM G24-66 is not the most recent version of that standard and cited instead G24-73. The Motor Vehicle Manufacturers Association stated that its member companies had not yet had a chance to evaluate the new ASTM procedures and indicated that they could involve significant changes. Both commenters requested that a new proposal be issued before a final amendment involving the resistance to light requirements is issued. The agency realizes that the new ASTM procedures may involve substantial changes in the test procedures and does intend to issue an additional proposal prior to updating that aspect of the Standard No. 209 test procedures (pending completion of additional testing, as noted in the notice of proposed rulemaking).

Two commenters, American Motors Corporation and Ms. Patricia Hill, pointed out a discrepancy between the Occupant Weight and Dimension Charts referenced in S4.1(g)(3) of Standard No. 209 and in S7.1.3 of Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208). The hip breadth (sitting) for the 95th percentile adult male is listed as 16.4 inches in the former and as 16.5 inches in the latter. To remove this discrepancy, this notice amends the chart in Standard No. 209 to agree with the chart in Standard No. 208 (i.e., to read 16.5 inches). (Originally, the chart in Standard No. 208 also listed the hip breadth as 16.4 inches. This was amended January 8, 1981, to be consistent with the dimensions of the Part 572 test dummy (46 FR 2064)).

The American Seat Belt Council noted that a

more recent version of AATCC Test Method 30 (30-81), Resistance to Microorganisms, has been issued than was noted in the proposal (which referenced 30-79). The agency has reviewed this latest version and determined that the only difference between 30-79 and 30-81 is the optional addition of glucose to the test culture used in Test III. The agency agrees with this option and therefore is incorporating AATCC Method 30-81 in this amendment.

The notice of proposed rulemaking preceding this amendment also solicited comments, information and data from the public concerning any current requirements of Standard No. 209 which possibly impose a regulatory burden and have a negligible or inconsequential impact on safety. The agency solicited this information as part of its regulatory review of all existing regulations. All comments to the proposal included suggested changes or revisions to reduce burdens, clarify requirements or to harmonize Standard No. 209 with European standards. These comments are currently being reviewed by the agency under its Regulatory Reform program and may lead to additional rulemaking to reduce or eliminate regulatory burdens imposed by Standard No. 209. (Persons interested in the recommended changes should consult comments to the proposal: Docket 82-15; Notice 1.)

In addition to the amendments discussed earlier, this notice also amends 49 CFR Part 571.5, Matter Incorporated by Reference, to list the address of the American Association of Textile Chemists and Colorists (AATCC). This amendment will assist interested parties in obtaining copies of the AATCC test procedures which are incorporated by reference in Standard No. 209.

The amendments included in this notice are to become effective 30 days after the date of this publication. The Administrator has determined that there is good cause for an effective date sooner than 180 days because this amendment only updates material incorporated by reference and makes no real substantive changes in the standard. Consequently, the burdens on manufacturers will in no way be increased.

Executive Order 12291

The agency has evaluated the economic and other impacts of this final rule and determined that they are neither major as defined by Executive Order 12291 nor significant as defined by the Department of Transportation's regulatory policies and procedures. The final rule only updates references to recommended practices and test methods already incorporated by reference in Standard No. 209. Because the economic and other effects of this proposal are so minimal, a full regulatory evaluation has not been prepared.

Regulatory Flexibility Act

In accordance with the Regulatory Flexibility Act, the agency has evaluated the effects of this action on small entities. Based on that evaluation, I certify that the final rule will not have a significant economic impact on a substantial number of small entities. Accordingly, no regulatory flexibility analysis has been prepared.

Only a few of the vehicle and parts manufacturers required to comply with Standard No. 209 are small businesses as defined by the Regulatory Flexibility Act. Small organizations and governmental jurisdictions which purchase fleets of motor vehicles would not be significantly affected by the amendments. The final rule merely updates references to test methods and recommended practices incorporated by reference in Standard No. 209. These updates should not impose any costs or other burdens.

PART 571—FEDERAL MOTOR VEHICLE SAFETY STANDARDS

In consideration of the foregoing, the following amendments are made to Title 49, Chapter V, § 571.209, *Seat Belt Assemblies*, and § 571.5, Matter incorporated by reference:

§ 571.209 [Amended]

1. The first sentence of S4.1(f) is revised to read as follows:

* * * * *

S4.1 * * *

(f) *Attachment hardware.* A seat belt assembly shall include all hardware necessary for installation in a motor vehicle in accordance with Society of Automotive Engineers Recommended Practice J800c, "Motor Vehicle Seat Belt Installation," November 1973. * * *

* * * * *

2. The chart included in S4.1(g)(3) is amended so that the dimension for hip breadth (sitting) for the 95th percentile adult male reads as follows:

S4.1(g) * * *

(3) * * *

Hip breadth (sitting). . . . 12.8 in. . . . . 16.5 in.

3. The last sentence of S4.1(k) is revised to read as follows:

* * * * *

S4.1 * * *

(k) *Installation instructions.* * * * The installation instructions shall state whether the assembly is for universal installation or for installation only in specifically stated motor vehicles, and shall include at least those items specified in SAE Recommended Practice J800c, "Motor Vehicle Seat Belt Installations," November 1973.

* * * * *

4. The second sentence of S4.3(a)(1) is revised to read as follows:

* * * * *

S4.3 * * *

(a) *Corrosion resistance. (1)* * * * Alternatively, such hardware at or near the floor shall be protected against corrosion by at least an electrodeposited coating of nickel, or copper and nickel with at least a service condition number of SC2, and other attachment hardware shall be protected by an electrodeposited coating of nickel, or copper and nickel with a service condition number of SC1, in accordance with American Society for Testing and Materials B456-79, "Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium," but such hardware shall not be racked for electroplating in locations subjected to maximum stress.

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5. The first sentence of S5.1(b) is revised to read as follows:

* * * * *

S5.1 * * *

(b) *Breaking strength.* Webbing from three seat belt assemblies shall be conditioned in accordance with paragraph (a) of this section and tested for breaking strength in a testing machine of capacity verified to have an error of not more than one percent in the range of the breaking strength of the webbing in accordance with American Society for Testing and Materials E4-79, "Standard Methods of Load Verification of Testing Machines."

* * * * *

6. The first sentence of S5.1(f) is revised to read as follows:

* * * * *

S5.1 * * *

(f) *Resistance to microorganisms.* Webbing at least 20 inches or 50 centimeters in length from three seat belt assemblies shall first be preconditioned in accordance with Appendix A(1) and (2) of American Association of Textile Chemists and Colorists Test Method 30-81, "Fungicides Evaluation on Textiles; Mildew and Rot Resistance of Textiles," and then subjected to Test I, "Soil Burial Test" of that test method.

* * * * *

7. Paragraph (g) of S5.1 is revised to read as follows:

* * * * *

S5.1 * * *

(g) *Colorfastness to crocking.* Webbing from three seat belt assemblies shall be tested by the procedure specified in American Association of Textile Chemists and Colorists Standard Test Method 8-181, "Colorfastness to Crocking: AATCC Crockmeter Method."

* * * * *

8. Paragraph (h) of S5.1 is revised to read as follows:

* * * * *

S5.1 * * *

(h) *Colorfastness to staining.* Webbing from three seat belt assemblies shall be tested by the procedure specified in American Association of Textile Chemists and Colorists (AATCC) Standard Test Method 107-1981, "Colorfastness to Water," except that the testing shall use (1) distilled water, (2) the AATCC perspiration tester, (3) a drying time of four hours, specified in section 7.4 of the AATCC procedure, and (4) section 9 of the AATCC test procedures to determine the colorfastness to staining on the AATCC Chromatic Transference Scale.

* * * * *

9. The first sentence of S5.2(a) is revised and a new sentence is added after the first sentence so that the two sentences read as follows:

S5.2 Hardware.—

(a) *Corrosion Resistance.* Three seat belt assemblies shall be tested in accordance with American Society for Testing and Materials B117-73, "Standard Method of Salt Spray (Fog) Testing." Any surface coating or material not intended for permanent retention on the metal parts during service life shall be removed prior to preparation of the test specimens for testing. * * *

* * * * *

10. The first sentence of S5.2(b) is revised to read as follows:

S5.2 *Hardware.*

* * * * *

(b) *Temperature resistance.* Three seat belt assemblies having plastic or nonmetallic hardware

or having retractors shall be subjected to the conditions prescribed in Procedure D of American Society for Testing and Materials D756-78, "Standard Practice for Determination of Weight and Shape Changes of Plastics under Accelerated Service Conditions." * * *

* * * * *

11. The eighth sentence of S5.2(k) is revised to read as follows:

* * * * *

S5.2 * * *

(k) * * * Then, the retractor and webbing shall be subjected to dust in a chamber similar to one illustrated in Figure 8 containing about 2 pounds or 0.9 kilogram of coarse grade dust conforming to the specification given in Society of Automotive Engineering Recommended Practice J726, "Air Cleaner Test Code" Sept. 1979. * * *

In § 571.5, paragraph (b)(5) is redesignated (b)(6) and a new paragraph (b)(5) is added to read as follows:

§ 571.5 *Matter incorporated by reference.*

* * * * *

(b) * * *

(5) *Test methods of the American Association of Textile Chemists and Colorists.* They are published by the American Association of Textile Chemists and Colorists. Information and copies can be obtained by writing to: American Association of Textile Chemists and Colorists, Post Office Box 886, Durham, NC.

(6) * * *

Issued on June 22, 1983

Diane K. Steed,
Acting Administrator.

48 F.R. 30138
June 30, 1983

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Seat Belt Assemblies
[Docket No. 80-06; Notice 3]

ACTION: Final rule.

SUMMARY: This notice amends Safety Standard No. 209, *Seat Belt Assemblies*, to alter the test procedure specified under the "resistance to light" requirements of the standard. This amendment is intended to establish an equivalent strength test for both nylon and polyester webbing materials used in seat belt assemblies. This amendment changes the test apparatus for polyester fibers by replacing the currently specified "Corex D" filter with a chemically strengthened or tempered soda-lime glass filter. The "Corex D" filter would still be utilized in testing nylon webbing, since it offers the best correlation with actual outdoor results when dealing with nylon webbing material.

EFFECTIVE DATE: September 18, 1985.

SUPPLEMENTARY INFORMATION: Under Safety Standard No. 209, *Seat Belt Assemblies* (49 CFR 571.209), seat belts must pass a "resistance to light" test (paragraph S4.2(e)). This test measures the strength and durability of the seat belt webbing material after exposure to sunlight. The "resistance to light" test represents an accelerated determination of outdoor exposure or aging. A rapid form of testing is needed so that webbing may be certified in accordance with Standard No. 209 and automotive companies' specifications prior to shipment.

On May 1, 1980, a Notice of Proposed Rulemaking (45 FR 29102) was issued, proposing an amendment to the procedure to be used in "resistance to light" tests. The original standard called for a "Corex D" filter in testing webbing material. The "Corex D" filter was an adequate test apparatus prior to the introduction of polyester webbing material for seat belts. Research had shown that although the specified test apparatus of a carbon arc light source combined with a "Corex D" filter, in general, was an effective method of simulating the effects of sunlight, it did result in the emission of certain radiations that were unrepresentative of the actual effects of natural sunlight. These peculiar radiations, which destroyed polyester but not nylon fibers, made the "Corex D" test procedure inappropriate for measuring the "resistance to light" requirements of seat belts containing polyester webbing material.

The proposed procedure replaced the required "Corex D" filter with a plain soda-lime glass filter in an attempt to create a similar, adequate testing for both nylon and polyester webbing material used in seat belt assemblies. Responses to that notice indicated that the proposed plain soda-lime glass filters were cracking either during the test cycle, due to the intense heat emitted during the 100 hours of test time, or after the test period, during the cool down of the equipment.

The Narrow Fabrics Institute, Inc. requested a delay in the rulemaking process in order to locate a less heat sensitive substitute. On September 16, 1980, the agency informed the Narrow Fabrics Institute, Inc. that the rulemaking process would be delayed until the development of a filter more resistant to thermal shock.

Upon completion of a 2-year search and a 1-year period of evaluation, the Narrow Fabrics Institue submitted a revised test apparatus. The improved filter was a chemically strengthened or tempered soda-lime glass. Testing done by the agency under Contract No. DTNH-22-83-P-02016 confirmed that the new filter maintained the same

light transmittance characteristics of the untreated soda-lime glass filter originally proposed, but was free of the previous thermal shock problems. The treated soda-lime glass filter produces an excellent correlation with actual outdoor results, for the proper accelerated degradation of polyester webbing, without the prior breakage difficulties.

A careful evaluation of data compiled over the past few years demonstrates that as to nylon webbing material, the "Corex D" filter still affords the best correlation with actual outdoor results. In light of these various findings, the agency proposed on November 28, 1983 (48 FR 53583) to amend the test procedure to reflect these results.

Four of the five commenters to the docket supported the proposed amendment to Standard No. 209. The other commenter, Renault, made two objections. First, it argued that the carbon arc light used in Standard No. 209 is unrepresentative of real use conditions. It urges the use of an xenon lamp. As stated previously, the use of the carbon arc light with the appropriate filters produces excellent correlation with actual outdoors test of the resistance to light capability of seat belts. The agency, therefore, does not believe it is necessary to propose an amendment to allow the use of an xenon lamp.

Renault also said that Standard No. 209 should not use different test procedures for different materials. It recommended that the agency not require the use of different filters, but instead specify the transmission band and spectral distribution of the radiation used in the test. Finally, Renault said that if the agency decides to require a filter, it should provide a more specific definition of the filter to be used in the testing. In particular, Renault asked that the agency specify the wave length of the light being used.

The agency disagrees with Renault concerning the use of different filters in the resistance to light test. The carbon arc test equipment used in the resistance to light test is a well-established test procedure that has been long used by the motor vehicle and seat belt industries. Tests conducted by the Narrow Fabrics Institute show that the carbon arc test equipment, when used with the appropriate filters, produces results comparable to actual outdoor resistance to light tests. Although the agency has decided to retain the use of the filters, it agrees with Renault that the specific characteristics of the new soda-lime filter need to be more precisely defined. The agency has obtained information on the transmittance of chemically strengthened soda-lime glass from the principal manufacturer of that device. Based on that information, the agency is amending the standard to specify the transmittance of the soda-lime glass to be used in the resistance to light test of polyester belts.

Update References

In the November 1983 notice, the agency proposed to update one of the American Society for Testing and Materials recommended practices incorporated by reference in the standard. The proposal to incorporate ASTM G23-81 was not opposed by the commenters and is therefore adopted.

PART 571—[AMENDED]

In consideration of the foregoing, paragraph S5.1(e) of Safety Standard No. 209, *Seat Belt Assemblies* (49 CFR 571.209), is amended by revising paragraph (e) to read as follows:

§571.209 Standard No. 209; seat belt assemblies.

S5.1 * * *

(e) *Resistance to Light.* Webbing at least 20 inches or 50 centimeters in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM Designation: G23-81, published by the American Society for Testing and Materials, except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wave lengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanameters. The apparatus shall be operated without water spray at an air temperature of 60 ± 2 degrees Celsius or 140 ± 3.6 degrees Fahrenheit measured at a point 1.0 ± 0.2 inch or 25 ± 5 millimeters outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimens shall be exposed to light from the carbon-arc for 100 hours and then conditioned as prescribed in paragraph (a) of this section. The colorfastness of the exposed and conditioned specimens shall be determined on the Geometric Gray

Scale issued by the American Association of Textile Chemists and Colorists. The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph (b) of this section. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained.

Issued on August 31, 1984.

Diane K. Steed
Administrator

49 FR 36507
September 18, 1984

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Seat Belt Assemblies
(Docket No. 74-14; Notice 53)

ACTION: Final rule.

SUMMARY: This final rule requires light trucks and light multipurpose passenger vehicles (e.g., utility vehicles capable of off-road use and van-type passenger vehicles) equipped with manual lap/shoulder safety belts for the front outboard seats to comply with the injury reduction criteria of Standard No. 208, *Occupant Crash Protection*, in a 30 mile per hour barrier crash test. This rule also responds to dummy positioning issues raised in petitions for reconsideration of the final rule adopting the use of the Hybrid III dummy.

The vehicles subject to this final rule are those with a gross vehicle weight rating (GVWR) of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less. Thus, this final rule will require the vast majority of multipurpose passenger vehicles and light trucks to meet the new manual belt performance requirements of the standard.

The GVWR and unloaded weight limits adopted in today's final rule will avoid imposing a testing and paperwork burden on most small businesses that either install a body on a chassis manufactured by another company or alter vehicles previously certified by other manufacturers. NHTSA is limiting the effects of this rule on small businesses to the extent possible, because most small businesses do not have the technical and financial resources necessary to do the testing or engineering analysis needed to determine whether their completed vehicles will meet the requirements of the new dynamic test for safety belts.

The dynamic test requirement will go into effect for multipurpose passenger vehicles and trucks with a gross vehicle weight rating of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less beginning on September 1, 1991. Unlike the dynamic test requirement for manual safety belts in passenger cars, the rule adopted today is not conditional. The requirement for cars with manual safety belts is conditional in that it becomes effective only if the automatic restraint requirement for cars is rescinded as a result of the enactment of State safety belt use laws covering two-thirds of the U.S. population and meeting criteria set forth in Standard No. 208.

DATES: The amendments made by this final rule are effective on May 23, 1988. Multipurpose passenger vehicles and trucks with a gross vehicle weight rating of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less must comply with the dynamic testing requirements of S4.6 of Standard No. 208 beginning on September 1, 1991.

SUPPLEMENTARY INFORMATION: On April 12, 1985 (50 FR 14589), NHTSA published a notice, which is the basis for the final rule being issued today, proposing a number of amendments to Standard No. 208, *Occupant Crash Protection*. Among the proposals was one that manual lap/shoulder belts installed at the front outboard seating positions of four different vehicle types comply with the dynamic testing requirements of Standard No. 208. That notice proposed to use test dummies in 30 mile per hour barrier crash tests to measure the level of protection offered by the vehicle's manual lap/shoulder safety belts. (The same test conditions and procedures are used for testing the protection provided by automatic restraint systems, such as automatic safety belts and air bags, in passenger cars.) The four vehicle types subject to this proposal were passenger cars and light trucks, buses, and multipurpose passenger vehicles, i.e., trucks, buses, and multipurpose passenger vehicles with a GVWR of 10,000 pounds or less and an unloaded vehicle weight of 5,500 pounds or less. On March 21, 1986 (51 FR 9800), NHTSA adopted a dynamic test requirement for manual lap/shoulder safety belts in the front outboard seats in passenger cars. The dynamic test requirement for manual lap/shoulder belts in passenger cars will go into effect on September 1, 1989, if the automatic restraint requirement is rescinded as a result of the enactment of State safety belt use laws covering two-thirds of the U.S. population and meeting criteria set forth in Standard No. 208.

This final rule adopts a dynamic test requirement for the lap/shoulder safety belts installed in the front outboard seating positions of light trucks and multipurpose passenger vehicles. Several of the issues discussed with respect to those vehicle types in this final rule, such as the adjustment that will

be made to safety belt tension-relieving devices prior to the crash test, have already been discussed with respect to passenger cars in prior agency final rules. To assist readers in understanding all of the effects of the new dynamic test requirement for safety belts in light trucks and multipurpose passenger vehicles, those discussions have been repeated in this final rule.

Dynamic testing of manual safety belts

Most of the commenters favored adopting a dynamic test requirement for manual belts, at least as to passenger cars, although many of those commenters raised questions about the leadtime needed to comply with the requirement. Those opposing the requirement argued that the field experience has shown that current manual safety belts provide substantial protection and thus a dynamic test requirement is not necessary. In addition, they argued that dynamic testing would substantially increase a manufacturer's testing costs and workload and could pose problems for final-stage manufacturers and vehicle alterers.

As discussed in detail below, the agency has now decided to adopt a dynamic test requirement for manual lap/shoulder belts in the front outboard seats of light trucks and light multipurpose passenger vehicles, which include such vehicles as light vans and light utility vehicles. To reduce potential problems for final-stage vehicle manufacturers and vehicle alterers, the agency is limiting the dynamic test requirement to vehicles which have a gross vehicle weight rating (GVWR) of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less. The requirement will go into effect for light trucks and light multipurpose passenger vehicles on September 1, 1991.

The agency has decided not to apply a dynamic test requirement to buses at this time. Standard No. 208 only requires the installation of a safety belt for the driver of a bus and gives manufacturers the option of installing either a lap safety belt or a lap/shoulder safety belt for the driver. The agency is concerned that applying a dynamic test requirement to a lap/shoulder belt that is voluntarily installed in a bus might encourage manufacturers to replace the lap/shoulder belt with a less costly lap belt, which would not be subject to a dynamic test requirement. Today's final rule should, however, also work to improve the safety of van-type buses since many of those vehicles are based on a chassis that is the same as or similar to the chassis used in light van-type multipurpose passenger vehicles that will be covered by the dynamic test requirement. (Under the agency's regulations, a bus is a vehicle that carries more than 10 persons. Thus, a van-type vehicle with four rows of seats that carries 12-15 people would be classified as a bus. Under the agency's regulations, a multipurpose passenger vehicle is a vehicle that is designed to carry 10 or less persons and is either built on a truck chassis or has features for occasional off-road use. Thus, a passenger van-type vehicle that is designed to carry 9 or fewer persons would be considered a multipurpose passenger vehicle.)

The issues raised by the commenters and the reasons for the agency's decisions are discussed below.

Safety need

As mentioned previously, most of the commenters favored the adoption of a dynamic test requirement for manual safety belt systems. The commenters favoring adoption of the requirement were the American Seat Belt Council, Center for Auto Safety, General Motors, Insurance Institute for Highway Safety, Mercedes-Benz, National Transportation Safety Board, Porsche, State Farm Mutual Insurance Co., and Volkswagen. In expressing their support for dynamic testing, the commenters generally did not distinguish between dynamic testing of safety belts in passenger cars and dynamic testing of safety belts in light trucks, buses and multipurpose passenger vehicles. The Insurance Institute for Highway Safety, however, did specifically address the dynamic testing of safety belts in vehicles other than passenger cars. It said that "requiring the dynamic testing of manual belts would result in the upgrading of the crash performance of many vehicles, including light trucks, vans, and utility vehicles, for which automatic restraint requirements have not yet been proposed."

The proposed dynamic test requirement was opposed by American Motors Corporation (AMC), Chrysler, Fiat, Ford, the Motor Vehicle Manufacturers Association (MVMA), and Toyota. In addition, Peugeot and Renault requested the agency to adopt a laboratory test procedure used by the Economic Commission for Europe rather than use a vehicle crash test to measure the dynamic performance of safety belts.

In questioning the safety need for dynamic testing, AMC, Chrysler, Ford, and MVMA said that current field data do not show a need for dynamic testing. Ford said that available crash data indicate "occupants of full-size light trucks are exposed to less risk of collision injuries than

occupants of either passenger cars or compact trucks. Moreover, full-size light trucks are far more likely to collide with smaller, lighter vehicles than with vehicles whose mass is comparable to or greater than that of such trucks." (In its comments, Ford explained that it used the term "full-size light truck" to mean trucks, such as its F-Series/Bronco and Econoline vehicles, that have derivatives with GVWR's greater than 8,500 pounds.) In addition, Ford said that a "30 mph fixed barrier test requirement represents an unrealistically severe test for many full-size light trucks because they weigh much more than typical passenger cars" and full-size light trucks "are not likely to experience an impact of 30 mph barrier equivalent velocity on the highway."

The agency strongly agrees with the commenters that current manual safety belts provide very substantial protection in a crash. The Department's 1984 occupant protection decision concluded that current manual safety belts, when worn, are at least as effective, and in some cases, more effective than current automatic belt designs. That conclusion was based on current manual safety belts, which are not certified to dynamic tests. However, as discussed in the April 1985 notice, the agency is concerned that as more tension-relieving devices are used on manual belts and as an increasing number of vehicles are reduced in size, the potential for occupant injury may increase. The agency is particularly concerned about ensuring the safety performance of belt systems used in the popular series of new compact trucks, utility vehicles, and minivans. The agency's concerns about ensuring adequate safety performance are substantiated by laboratory crash tests of current light trucks and multipurpose passenger vehicles. Each of these issues is addressed in more detail below.

Crash test performance of current vehicles

To evaluate the safety performance of current light trucks, buses, and multipurpose passenger vehicles, the agency has examined the results of 20 crash tests at 30 mph. In the 30 mph tests, only five of the 20 vehicles tested met both Standard No. 208's head injury criterion (HIC) and chest acceleration criterion at the driver and front right seat passenger positions. (In four other tests, at least one of the test dummies met both the HIC and chest acceleration criteria.) These test results suggest that the agency's concerns about ensuring adequate safety performance of these vehicles are not unfounded.

In addition, the agency has conducted 16 additional tests of those vehicles at 35 mph as a part of its experimental New Car Assessment Program (NCAP). The agency is aware of the fact that NCAP testing exposes vehicles to 36 percent greater crash forces than the 30 mph test. Because of these significantly higher crash forces, the agency has repeatedly stated that the fact that a vehicle did not comply with the Standard No. 208 criteria in an NCAP test should *not* be interpreted as implying that the vehicle would not comply with Standard No. 208 if it were tested in accordance with that Standard; i.e., subjected to a 30 mph frontal barrier crash. Although NCAP data alone would not indicate a basis for the agency's concern, they do, in this case, correlate reasonably well with the 30 mph test data. In the 35 mph tests, only three of the 16 vehicles tested met Standard No. 208's HIC and chest acceleration criteria at both front seating positions. (In four other tests, at least one of the test dummies met both the HIC and chest acceleration criteria.)

In addition to these test results, an analysis of fatalities in crashes of the various vehicle types in frontal impacts supports the agency's concerns about extending dynamic testing requirements to these additional groups of vehicles. Even though the analysis of fatalities shows that the fatality rates per million registered vehicles were nearly identical in 1985 for passenger cars and light trucks, at 86.9 and 80.4 respectively (see Table 6 of NHTSA's May, 1987 Report to Congress entitled "Light Truck and Van Safety"), some types of light trucks, especially compact pick-up trucks, had higher fatality rates. This rule will ensure adequate safety performance for *all* types of light trucks and multipurpose passenger vehicles, in the same way that Standard No. 208 now ensures adequate safety performance for all types of passenger cars.

Downsizing

Ford agreed with the agency that downsizing "is certainly evident in the new smaller pickup trucks, utility vehicles and minivans," but said that downsizing is "not evident in full-size pickups, MPV's, vans or buses. We do not expect any significant reduction in the size of full-size trucks, buses or MPV's in the foreseeable future." Ford also said that "downsizing has not affected interior geometry and thus, is not a valid rationale for requiring dynamic testing of belts."

The agency agrees with Ford that in their downsizing efforts, manufacturers have attempted to preserve the interior space of their vehicles, while reducing their exterior dimensions. Preserving the interior dimensions of the passenger compartment means that occupants will not be

placed closer to instrument panels and other vehicle structures which they could strike in a crash. However, the reduction in *exterior* dimensions in the new lines of compact trucks, utility and van-like vehicles can result in a lessening of the protective crush distance available in those vehicles. The reduction in crush space may mean that occupants may be subject to a higher degree of risk in downsized vehicles, even if the interior dimensions of the vehicle are the same as or similar to the dimensions of the older, full-size vehicle. Thus, the agency believes it is important to require dynamic testing to ensure that safety belts in downsized vehicles will perform adequately.

Ford raised another issue associated, in part, with downsizing: Ford said that because of the differences in vehicle weights, when light trucks and van-like vehicles strike passenger cars, the heavier truck or van-like vehicle will experience lower changes in velocity and thus will likely expose their occupants to less violent crash conditions. NHTSA agrees that this will be particularly true for the heavier vehicles excluded from the dynamic test requirement, which will experience a far lower change in velocity in an impact with a lighter passenger car. However, the change in velocity in impacts between a passenger car and a compact truck or multipurpose passenger vehicle, which represent most of the vehicles covered by today's final rule, will be similar. Thus, the crash test does not represent an overly severe test for lighter trucks and multipurpose passenger vehicles. In addition, the light trucks and van-like vehicles covered by today's rule also are involved in crashes with heavier vehicles and solid objects, such as trees and bridge abutments, which will result in high crash forces for these light vehicles. NHTSA believes that occupants of these light trucks and multipurpose passenger vehicles should be assured of the same level of protection as passenger car occupants in those crashes.

Webbing tension-relieving devices

The April 1985 notice explained that the agency was also concerned about the possible misuse of tension-relieving devices on manual belts. Tension-relieving devices are used to introduce slack in the shoulder portion of a lap/shoulder belt to reduce the pressure of the belt on an occupant or to effect a more comfortable "fit" of the belt to an occupant. The agency believed that the trend toward use of tension-relieving devices was another reason for requiring dynamic tests of safety belts. While recognizing that such devices could make belts more comfortable, thus increasing usage, the agency was also concerned that vehicle occupants may use the tension-relieving device to introduce too much slack in the safety belt and thus reduce its protection capability.

The notice proposed that manufacturers be required to specify in the owner's manuals for their vehicles the maximum amount of slack they recommend introducing into the belt under normal use conditions. Further, the owner's manual would be required to warn that introducing slack beyond the maximum amount specified by the manufacturer could significantly reduce the effectiveness of the belt in a crash. During the agency's dynamic testing of manual belts, the tension-relieving devices would be adjusted so as to introduce the maximum amount of slack specified in the owner's manual.

With the exception of Ford, those manufacturers who commented on the proposal concerning tension-relieving devices supported testing safety belts adjusted so that they have the amount of slack recommended by the manufacturer in the owner's manual. Ford said that requiring any slack to be introduced into the belt system would increase the variability of the dynamic test procedure, and thus reduce the objectivity of the test. Ford said that it might have to eliminate all tension-relieving devices for its safety belts.

The agency's proposed test procedure was intended to accommodate tension-relieving devices since, as noted above, they can increase the comfort of lap/shoulder safety belts, which in turn, should increase usage. At the same time, the proposal would limit the potential reduction in effectiveness for safety belts systems with excessive slack. The agency does not agree that this test procedure need result in the elimination of tension-relieving devices from the marketplace. As mentioned earlier, all the other manufacturers addressing this proposal supported it and did not indicate they would have to remove tension-relieving devices from their belt systems.

In addition, Ford did not provide any data showing that the variability of the tests will increase because of the new requirement. In particular, Ford did not show that injury levels cannot be controlled within the specified injury criteria by testing with the recommended amount of slack, as determined by the manufacturer. A manufacturer has the option of recommending that a very limited amount of slack be introduced into its safety belts to ensure that the injury reduction criteria of Standard No. 208 would be met with the slackened safety belt. The agency notes that as a practical matter, most tension relievers automatically introduce some slack into the belt for all occupants.

Testing without such slack would be unrealistic, since it would not represent how vehicle occupants will wear the safety belt in their vehicles.

CFAS and NTSB raised another objection about the proposed requirement. They objected to the proposal that manual belt systems using tension-relieving devices meet the injury criteria with only the specified amount of slack recommended in the owner's manual. They stated that most owners would not read the instructions in the owner's manual regarding the proper use of the tension-relieving device. They said an occupant could have a false sense of adequate restraint when wearing a belt system adjusted beyond the recommended limit.

The agency's views on allowing the use of tension-relievers in safety belts were detailed in the April 1985 notice. The agency specifically noted the effectiveness of a safety belt system could be compromised if excessive slack were introduced into the belt. However, the agency recognizes that a belt system must be used to be effective at all. Allowing manufacturers to install tension-relieving devices makes it possible for an occupant to introduce a small amount of slack to relieve shoulder belt pressure or to divert the belt away from the neck. As a result, safety belt use is promoted. This factor should outweigh any loss in effectiveness due to the introduction of a recommended amount of slack in normal use. This is particularly likely in view of the requirement that the belt system, as adjusted, must meet the injury criteria of Standard No. 208 under 30 mph test conditions. Further, the agency believes that the inadvertent introduction of slack into a belt system, which is beyond that for normal use, is unlikely in most current systems.

Feasibility

In questioning the feasibility of meeting the requirements in full-size vehicles, Ford said it knew of no test data indicating that any vehicle in the full-size bus/multipurpose passenger vehicle class can meet the proposed requirements. Ford also said it was unsure whether modifying its vehicles to meet the dynamic test requirement might require it to stiffen the front end of the vehicles or develop a less stiff front end that "could preclude concurrent compliance to the 212/219 standards." Finally, Ford said that the dynamic test requirement "would be complicated by the broad range of vehicles produced with a variety of interchangeable parts." In particular, it said that high GVWR vehicles have different vehicle and dummy movement than the lower GVWR models from which the high GVWR vehicles are derived. Ford said that these "differences argue against requiring lower GVWR derivatives to meet the injury criteria, because such a requirement may jeopardize the commonality of body components across the truck line and the truck's function and may even adversely affect the occupant protection offered in higher GVWR trucks." Fiat and Toyota also said that it is more difficult to design light trucks and van-like vehicles to conform to a dynamic test requirement and asked the agency to exclude those vehicles from the proposed requirement.

As discussed in the regulatory evaluation for this rulemaking action, the agency has examined test results of light trucks, buses, and multipurpose passenger vehicles at both 30 and 35 mph. Those results show that it is possible for the heavier light trucks and vans to meet the HIC, femur load, and chest acceleration criteria. The test results from the agency's 30 mph tests show that the Ford F-250 pickup truck, with a test weight of 4,866 pounds, and a Ford R-100 pickup truck, with a test weight of 3,163 pounds, met the HIC and chest acceleration requirements. The heaviest vehicle tested in the 30 mph crashes, a Ford P-500 van with a test weight of 5,796 pounds, met the HIC and chest acceleration criteria for the driver; the data for the passenger are not available. The results also show that a Chevrolet K-10 pickup truck with a test weight of 5,401 pounds, met the head injury criterion, and met the chest acceleration criterion for the passenger; the data on the chest acceleration criterion for the driver are not available.

Even at higher speeds, heavier vehicles can meet the dynamic test. For example, NHTSA has examined its NCAP test results and identified two heavier vehicles that met the proposed requirements in 35 mph tests, which involve 36 percent more energy than the 30 mph crash test that will be used in dynamic testing of safety belts. Those vehicles are a Chevrolet C-10 pickup truck, with a test weight of 4,830 pounds, and a Toyota Van-Wagon, with a test weight of 3,616 pounds. Those vehicles were also tested and found to meet Standard No. 212, *Windshield Retention*. Although these results indicate that the requirements are feasible, the agency recognizes that manufacturers will need additional leadtime to develop and produce the necessary design changes that must be made to bring the rest of their vehicles into compliance.

Aggressivity

Ford and MVMA argued that the aggressivity of these vehicles may increase because of design changes required to meet the proposed standard (aggressivity refers to the possibility of increasing the stiffness of a vehicle so that when it strikes another vehicle, the stiffened vehicle inflicts greater damage on the struck vehicle than it would otherwise have done.) However, neither commenter provided data showing that these vehicles would necessarily become more aggressive. NHTSA analysis of existing NCAP data shows that softening rather than stiffening the front structure of a vehicle can improve its crash performance without increasing its aggressivity. (See the results presented in "A Review of the Effects of Belt Systems, Steering Assemblies, and Structural Design on the Safety Performance of Vehicles in the New Car Assessment Program." Hackney and Ellyson, Tenth International Technical Conference on Experimental Safety Vehicles, 1985.)

Effect on final-stage manufacturers and alterers

Ford and MVMA also raised questions about the effect of dynamic testing of full-size light trucks on final-stage manufacturers and vehicle alterers. Ford said that final-stage manufacturers, such as van converters, who install their own seats in a vehicle could not rely on the incomplete vehicle manufacturer's testing to certify compliance because changes in the seat or belt mounting could invalidate the results of the prior dynamic testing. Likewise, Ford said final-stage manufacturers that add additional equipment to a vehicle could be affected since Ford "would most likely have to recommend stringent limitations on vehicle weight distribution and center of gravity height in order that our crash test results might be approximately representative of the results obtained in tests of the vehicles as completed or altered."

After examining this issue, the agency agrees that dynamic testing of safety belts can pose a problem for final-stage manufacturers and vehicle alterers. NHTSA believes that these parties do not generally have the necessary technical and financial resources to do the vehicle testing or engineering analysis necessary to determine if the safety belts in their altered vehicles meet the dynamic test requirements. Accordingly, this rule limits the effects on these small businesses to the extent possible. NHTSA has obtained information from the Truck Body and Equipment Association which indicates that 90-95 percent of multi-stage manufacturers among its members use vehicles with a GVWR of greater than 8,500 pounds. To reduce the potential problem for final-stage manufacturers and alterers, the agency has decided to limit the applicability of the dynamic test requirement to vehicles with a gross vehicle weight rating of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less.

As another approach to limiting the effect of the rule on final-stage manufacturers, the agency had proposed to exclude motor homes. Most, if not all, motor homes, with a GVWR of 10,000 pounds or less, are built on a van cutaway chassis, which consists of the front end and chassis of a van. The number of such vehicles is limited. For example, in 1985, approximately 28,000 van cutaway chassis were used for motor homes. No commenter opposed the proposed exclusion of motor homes and it is thus adopted in the final rule. The agency also proposed to exclude open-body type vehicles, walk-in van-type trucks, vehicles designed exclusively to be sold to the U.S. Postal Service and vehicles carrying chassis-mount campers. These exclusions were also not opposed and are therefore adopted in today's final rule.

Applying the dynamic test requirement to vehicles with a GVWR of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less will cover the vast majority of light trucks and multipurpose passenger vehicles. The agency projects that for model year 1992, there will be sales of 4.4 million vehicles, other than passenger cars, with a GVWR of up to 10,000 pounds. Of those vehicles, approximately 3.8 million will have a GVWR of 8,500 pounds or less. The remaining 0.6 million, which represent approximately 14 percent of the total, will have a GVWR in the 8,501 to 10,000 pound range. The dynamic test requirement adopted today should also have a safety benefit for the vehicles in the 8,501 to 10,000 pound GVWR range. Many of these vehicles are derived from vehicles with a GVWR of 8,500 pounds or less. The type of structural and safety belt system changes made to the vehicles covered by today's final rule should also benefit occupants in the derivative vehicles.

Forward control vehicles

GM said that it had limited data on the ability of forward control vehicles to meet a dynamic performance test. GM said that, based on engineering studies, it believes that the limited crush space in those vehicles may not make it possible to meet the proposed requirements, at least not by the proposed September 1, 1989 effective date.

In supplemental comments filed with the agency, GM said it was also concerned about the ability of some forward control-type vehicles to meet the proposed requirements. GM explained that those forward control-type vehicles do not meet the agency's definition of forward control, but do have the same or similar limited crush space. (Part 571.3 of the agency's regulations define a forward control vehicle as a vehicle in which at least half the engine is located rearward of the windshield and the steering wheel is located in the front quarter of the vehicle.) GM further explained that two of its three series of light trucks and multipurpose passenger vehicles are forward control vehicles that meet the agency's definition of that term. Those two forward control vehicle series are the G series vans, which are full-size vans, and the P series vehicles, which consist of either a completed walk-in van-type vehicle or a chassis that is completed by final-stage manufacturers into walk-in van-type vehicles, such as parcel delivery trucks. In the case of its M series vehicles, which are minivans, GM said that while those vehicles do not meet the agency's definition of forward control, they are forward control *type* vehicles.

GM's submission contained data from two 30 mph crash tests of the M series vehicles using Hybrid III test dummies, in which some of the HIC, chest acceleration and chest deflection readings exceeded the values set in Standard No. 208. GM said that "These type of test results are to be anticipated from vehicle decelerations which do not benefit significantly from energy dissipation due to frontal crush. Further, a greater amount of passenger compartment deformation would be expected in barrier tests of forward control type vehicles, another factor that probably contributed to the observed injury criteria values." GM also noted that the agency's NCAP test results for the M series van also showed the difficulty of meeting Standard No. 208's test requirements in those vehicles. GM suggested that the agency consider establishing other injury criteria levels for forward control type vehicles or excluding those vehicles from the dynamic test requirement. GM also requested NHTSA to consider revising the agency's definition of forward control vehicle.

The agency recognizes that because of the smaller amount of frontal crush space available in forward control and forward control type vehicles, it is more difficult to provide occupant crash protection in frontal crashes of those vehicles. However, there is information showing that those vehicles can be designed to meet the performance requirements of Standard No. 208. In its NCAP program, the agency has tested a 1984 Toyota Van, which is a forward control vehicle, in a 35 mph barrier impact test. In that test, which is a more severe test than the 30 mph barrier impact used in Standard No. 208, both the driver and passenger test dummies did not exceed the HIC and chest acceleration limits set in the standard. The femur loads for the driver did exceed the limit in Standard No. 208, but the passenger's femur loads were well below the limit. NHTSA believes that with the longer leadtime provided by this notice, manufacturers can adopt appropriate changes to enable forward control and forward control type vehicles to meet the performance requirement of Standard No. 208. Therefore, the agency has decided not to exempt forward control or forward control type vehicles from the dynamic test requirement.

Dummy positioning in light trucks

In its comments, Ford expressed concern about whether the test dummy positioning procedure used in passenger cars can be used in light trucks. In particular, Ford said that the more upright seat backs found in some light trucks might prevent use of the current positioning procedure.

To address Ford's concern, the agency recently conducted a test series at its Vehicle Research and Test Center in which the agency examined twenty-four different light trucks, vans, and utility vehicles to identify any problems in positioning a SAE H-point machine, which is a manikin representing the weight and dimensions of a 50th percentile male, and a Hybrid III test dummy in those vehicles. The vehicles chosen represented five different vehicle categories: compact and full-size light trucks, compact multipurpose passenger vehicles, minivans, and full-size vans.

Based on its examination and testing of the vehicles, the agency concluded that the SAE H-point machine could be positioned in 15 of the vehicles without any actual or expected difficulty. In the remaining 9 vehicles, the agency did experience some difficulty in positioning the left leg of the H-point machine. However, NHTSA was successful in ultimately positioning the H-point machine in each of the vehicles. The difficulty was caused by the presence of large engine covers in van-type vehicles and a large transmission tunnel in a full-size truck. In those vehicles, the engine cover or transmission tunnel protruded into the passenger's footspace and reduced the space available for placement of the left leg of the H-point machine. In three vehicles the agency had to remove the left leg of the H-point machine in order

to be able to position the manikin in the passenger's seat. As long as the weight represented by the left leg is added to the manikin, the agency does not believe that removal of the left leg will affect the determination of the H-point.

Based on its examination and testing, the agency concluded that the Hybrid III test dummy could be positioned in 15 of the vehicles without any actual or expected difficulty. In nine of the vehicles in which the agency identified potential problems, the agency was able to position a Hybrid III test dummy in each of those vehicles using the existing positioning procedure. In each of those vehicles, the agency was able to meet the H-point orientation, pelvic angle and head orientation specifications set for the Hybrid III in Standard No. 208. (A copy of the results for the VRTC testing has been placed in the General Reference section of Docket 74-14.)

As a result of the test series, the agency is adopting one change in the positioning procedure for the Hybrid III. During the tests, NHTSA experienced a problem in placing the Hybrid III in vehicles that had very upright seats with non-adjustable seatbacks. In those vehicles, it was necessary to level the head of the test dummy by adjusting the lower neck bracket of the test dummy. The effect of adjusting the neck bracket is to move the head slightly rearward.

To ensure consistency in the placement of the head when positioning the test dummy in an upright seat with a non-adjustable back, the agency is adopting a sequence of positioning procedures it will follow in adjusting a test dummy in such a seat to level its head. The agency will first adjust the position of the H-point within the limits set forth in the standard in an effort to level the head of the test dummy. If that approach is not successful, the agency will then adjust the pelvic angle of the test dummy, again within the limits provided in the standard. If the head is still not level, the agency will then adjust the neck bracket the minimum amount necessary to level the head. By setting out this sequence, the agency expects to reduce the possibility that different testing organizations will position the test dummy in substantially different ways in an effort to level the head of the test dummy.

Petitions for reconsideration regarding Hybrid III positioning

Subsequent to issuance of the July 25, 1986 (51 FR 26688) final rule adopting the use of the Hybrid III test dummy, a number of manufacturers filed petitions for reconsideration. A number of the issues raised in those petitions for reconsideration involved the positioning of the Hybrid III test dummy. NHTSA has decided to address the positioning issues in this notice, since they affect the positioning procedures that can be used in testing light trucks. At a later date, the agency will address the remaining petitions for reconsideration of the final rule on the Hybrid III test dummy.

Use of different test dummies in different tests

In its petition for reconsideration, the Motor Vehicle Manufacturers Association (MVMA) asked NHTSA to clarify a statement the agency made on the use of the Hybrid III in non-instrumented testing, such as the comfort and convenience testing. MVMA said that it was unclear from the agency's statement in the preamble to the July 25, 1986 final rule whether either test dummy can be used, at the manufacturer's option, to test for compliance with the comfort and convenience requirements, regardless of which test dummy is used in the barrier crash test.

NHTSA's intention was to allow manufacturers, at their option, to specify the use of either test dummy in the instrumented tests and also to permit manufacturers to specify the use of either test dummy in the non-instrumented tests of the standard. Thus, a manufacturer can specify the use of a Hybrid III in the crash test and a Part 572 Subpart B test dummy in the comfort and convenience tests. The July 1986 rule did, however, make clear that manufacturers will only have the option of using either test dummy until September 1, 1991. At that time, the use of the Hybrid III is mandatory for testing passenger cars to the instrumented and non-instrumented testing requirements of Standard No. 208. (Throughout this preamble, the agency refers to the currently specified September 1, 1991 date for mandatory use of the Hybrid III test dummy for compliance testing of passenger cars. The agency would like to note that this mandatory use date was the subject of numerous petitions for reconsideration. The agency is evaluating those petitions at this time, and will announce its decision on any change to that mandatory use date when it responds to those petitions).

In its petition, MVMA also noted that the latchplate access portion of the comfort and convenience requirement needs to be modified to accommodate the use of the Hybrid III test dummy in that test. To determine whether a car complies with that requirement, the standard uses two reach strings attached to the test dummy. To demonstrate com-

pliance, a manufacturer must show that a stowed latchplate is located within the arcs generated by moving the ends of the strings attached to the test dummy. MVMA said that its "comparison of the physical characteristics of the two dummies indicates that there is a significant difference in the seated attitude of the two dummies and in the respective positions of the two dummies' heads." These differences mean that arcs generated by using the two test dummies are different.

MVMA is correct that the requirements of the standard need to be amended. The positioning of the reach strings shown in Figure 3 of the standard is based on the seated position of a Part 572 Subpart B test dummy. Since the Hybrid III has a slightly different seated position, it is necessary to specify different locations for attaching the reach strings on a Hybrid III test dummy. NHTSA has amended the standard to set out the attachment locations for the latchplate access test strings on a Part 572 Subpart B test dummy in Figure 3 A and the attachment locations on a Hybrid III test dummy in Figure 3 B.

Use of different test dummies in the same test

In its petition for reconsideration, Renault asked the agency to permit manufacturers to specify the use of different test dummies at different seating positions in the same crash test. As discussed above, NHTSA believes that prior to September 1, 1991, manufacturers should have the option of choosing which of the test dummies they will use to certify that their vehicles meet the requirements of Standard No. 208. Thus, prior to September 1, 1991, a manufacturer may choose to use, for example, a Hybrid III at the driver's seating position and a Part 572 Subpart B test dummy at the passenger's seating position. On or after September 1, 1991, manufacturers' certifications must be based on the use of the Hybrid III in the driver's and front right outboard seating position is mandatory in passenger car testing. As discussed below, the agency has decided to permit the use of either the Part 572 Subpart B test dummy or the Hybrid III test dummy for testing in vehicles other than passenger cars after 1991.

Indefinite use of Part 572 Subpart B dummy in non-passenger car testing

Today's final rule marks the first time that NHTSA will check compliance with Standard No. 208 for light trucks and multipurpose passenger vehicles by conducting crash tests of those vehicles using instrumented test dummies positioned in accordance with the detailed requirements of Standard No. 208. Although the agency has placed uninstrumented test dummies in those vehicles for compliance testing under other standards, such as Standard Nos. 212 and 219, those standards do not contain detailed test dummy positioning requirements. NHTSA recognizes that while manufacturers have conducted numerous crash tests of passenger cars in accordance with Standard No. 208 to certify compliance with the automatic restraint requirements, manufacturers have not conducted as many similar tests with light trucks and multipurpose passenger vehicles to measure the performance of the safety belt systems in those vehicles. In particular, the agency recognizes that manufacturers have had only limited experience in positioning and using Hybrid III test dummies in light trucks and multipurpose passenger vehicles. As discussed in more detail below, the agency recognizes that it can be difficult to position the Hybrid III test dummy in some light trucks and multipurpose passenger vehicles.

To allow manufacturers to gain more experience with the Hybrid III test dummy, NHTSA has decided to permit temporarily the use of either the Part 572 Subpart B or Hybrid III test dummy in Standard No. 208 compliance testing for light trucks and multipurpose passenger vehicles after September 1, 1991. The agency will continue to monitor its own testing experiences and the manufacturers' experiences in using the Hybrid III test dummy in light trucks and multipurpose passenger vehicles. After evaluating experiences with the Hybrid III test dummy, NHTSA will announce in a subsequent rulemaking when the use of that test dummy will become mandatory for compliance testing for light trucks and multipurpose passenger vehicles.

Foot positioning

Ford said the positioning specification adopted for placement of the driver's left foot and for placement of the passenger test dummy's feet were not clear. In particular, Ford said that the agency should clarify the term "floor surface" to indicate whether the agency is referring to the floor pan or the toeboard. Ford also recommended adopting the same foot positioning requirements for the Hybrid III as are used for the older Part 572 Subpart B test dummy.

Toyota raised a similar issue concerning the placement of the Hybrid III's feet and also recommended that NHTSA use the same foot positioning

procedures for the Hybrid III as are used for the Part 572 Subpart B test dummy. In particular, Toyota said that the same procedures should be used for such things as the Hybrid III's foot location when there is a footrest or wheelwell in the passenger compartment. Toyota noted that because of structural differences between the two test dummies, each dummy should continue to have different initial spacing requirements for the knees.

The agency adopted the positioning procedures for the Hybrid III's feet before it had issued the revisions to the feet positioning procedures for the Part 572 Subpart B test dummy. NHTSA agrees with Ford and Toyota that the foot positioning procedures for the two test dummies should be the same. NHTSA has made the necessary changes to the Hybrid III foot positioning procedures to conform them with the procedures used with the Part 572 Subpart B test dummy. So as not to invalidate any design and development work that manufacturers have done using the foot positioning procedures adopted in July 1986, NHTSA is providing that manufacturers have the option of using either positioning procedure until September 1, 1991. In response to Ford's request, NHTSA has also clarified the use of the term "floor surface" in the July 1985 foot positioning procedures to distinguish between the floor pan and the toeboard.

Leg positioning

In its petition for reconsideration, Toyota noted that there were several slight differences between the leg positioning procedure for the Hybrid III and the Part 572 Subpart B test dummies and requested the agency to resolve those differences. Toyota noted that there is no requirement specifying the initial knee position of the driver's left leg for the Hybrid III. In addition, Toyota noted that there is no requirement that the upper and lower leg centerlines of the driver's right leg fall as nearly as possible in a vertical plane.

The positioning specifications for the Hybrid III currently contain a requirement concerning the initial distance between the knees of the Hybrid III test dummy. Since this specification concerns only the initial placement of the knee, the agency does not believe it is necessary to further define the specific initial placement of the driver's right knee. As emphasized in the July 1986 final rule, the knee spacing requirement for the Hybrid III and the part 572 Subpart B test dummies are merely initial settings. The agency recognizes that the spacing can change as the test dummy is adjusted to meet the other positioning requirements. Therefore, the agency does not believe it is necessary to further specify the initial placement of the driver's right knee for the Hybrid III test dummy.

NHTSA does, however, agree with Toyota that the requirements for the positioning of the leg centerlines for the driver's right leg should be the same for both test dummies. The agency has therefore modified the Hybrid III positioning procedures to provide that the centerlines of the driver's upper and lower leg should fall as nearly as possible in a vertical plane.

Hip point placement

The July 1986 final rule provided for positioning the lower torso of the hybrid III with reference to several dimensions established by positioning the Society of Automotive Engineers (SAE) H-point machine on the vehicle's seat. (The H-point machine used in positioning the Hybrid III is a three-dimensional manikin that represents the weight and dimensions of a 50th percentile male.) In particular, the procedure calls for locating the hip point of the Hybrid III test dummy so that it is within 1/2 inch vertically and 1/2 inch longitudinally of a point determined by use of the H-point machine. Ford recommended that the tolerances for the longitudinal location of the dummy's hip point be reduced to 1/4 inch to reduce the possibility of test variability. Ford did not, however, provide any evidence indicating that reducing the tolerances would significantly reduce test variability. In the absence of such data, the agency has decided to deny Ford's request.

Pelvic angle

The July 1986 final rule provided for positioning the pelvic angle of the Hybrid III so that the angle is 22 1/2 degrees plus or minus 2 1/2 degrees. Ford said that the permitted five degree tolerance band is "unnecessarily broad." Ford recommended that the tolerance be reduced to 22 degrees plus or minus one degree.

NHTSA is not adopting Ford's recommended change. The current range of permissible pelvic angles is needed to make it easier to adjust the leg placement of the test dummy. In addition, the current range of permissible angles also makes it easier to rotate the torso of the test dummy to level its head once the tet dummy has been placed on the vehicle seat.

Head positioning

The July 1986 final rule provided that the head

shall be positioned so that the head accelerometer mounting platform is horizontal within 1/2 degree. Ford recommended that the test dummy's head "be positioned 5 inches plus or minus 1/4 inch rearward of its hip position to minimize variations in fore-and-aft head positioning." Ford also said that positioning the head in this manner is "consistent with the typical seat back angle in cars and the 22 degree pelvic angle, and will keep the head accelerometer mounting platform essentially horizontal."

The agency has successfully used the current head positioning procedures to obtain a consistent positioning of the Hybrid III's head relative to different vehicle interiors. As discussed earlier in this notice, the agency has decided to adopt a minor change in the positioning requirements to address the minor difficulty the agency has experienced in positioning the Hybrid III in an upright vehicle seat with a non-adjustable seat back. Since the current procedure, with the minor change adopted in this notice, has proved to consistently position the head, the agency is not adopting Ford's suggested alternative.

Torso positioning

The July 1986 final rule provided for positioning the upper torso of the Hybrid III so that it rests against the seat back. Toyota said that it has attempted to position a Hybrid III test dummy using this procedure and "found that the head position of the dummy is not consistent and is significantly influenced by the force applied to the upper torso when positioning the dummy." Toyota requested the agency to set a specific load to be applied to the upper torso of the Hybrid III while positioning the test dummy.

When NHTSA adopted the final rule on the Hybrid III test dummy, the agency consciously decided not to specify the step-by-step procedure that must be used to reach the prescribed final position. Instead, the Hybrid III dummy positioning specifications set forth the final position in which the test dummy should be before the crash test is conducted, such as having the head level and the pelvic angle adjusted within a specified range. The agency believes that the test dummy will be properly positioned when these procedures are followed. Consequently, there is no need for this rule to establish a specific load to be used in positioning the upper torso of the Hybrid III.

Hand placement

The July 1986 final rule called for positioning the hands of the Hybrid III test dummy so that they are in contact with the steering wheel and attaching the thumbs to the steering wheel. with adhesive tape with a breakaway force of between 2 to 5 pounds. Toyota said that the standard does not provide a procedure for measuring the breakaway force. In addition, Toyota said that the positioning procedure for the existing Part 572 Subpart B test dummy does not call for taping the thumbs to the steering wheel rim. It suggested the agency to drop the taping requirement for the Hybrid III. Ford requested using the term "masking tape" rather than "adhesive tape." Ford said that the term "adhesive tape" is "commonly used to mean medical cloth or plastic tape that would not meet the 2 to 5 pound breakaway force specification."

NHTSA has used a procedure of lightly taping the thumbs of the Hybrid III to the steering wheel in its crash tests. The agency has found that this practice is helpful in maintaining the test dummy's hands in place on the steering wheel as technicians make adjustments to the position of the test dummy. The tape is also helpful in keeping the test dummy's hands on the steering wheel as the vehicle is accelerated toward the barrier in a crash test.

The agency has not previously specified a test to measure breakaway force of the tape since the tape is used as a convenience feature to reduce the number of times a technician must reposition the hands as he or she makes final minor adjustments to the test dummies' positions prior to a crash test. NHTSA believes that a simple means of determining whether the tape meets the 2 to 5 pound breakaway force requirement is simply to provide that when the test dummy's hand is moved upward with a force of not less than 2 pounds and not more than 5 pounds, the tape must break away. The agency does not believe it is necessary to specify whether the tape should be masking or adhesive tape, as long as the tape can meet the breakaway requirement. Thus, the agency has deleted the word "adhesive".

Leadtime

In commenting on the leadtime needed to meet the proposed requirements, Ford said that it would need to conduct pre-program design studies lasting up to 12 months on each of its four basic truck lines. It said the studies would be needed to determine how to comply with the proposed requirements without "jeopardizing the intended functions of these trucks, increasing their aggressivity, or threatening the existence of the many small final-stage manufacturers that use our trucks as the base for their products." Ford said that these pre-

program studies would have to be completed before it could begin normal programs, taking up to 54 months, to make the necessary changes, which could involve changes to the front end structure, steering system, chassis, instrument panel, engine mounting and seating systems. Ford also said it "does not have the personnel or engineering facilities to make major changes in all of its truck lines at the same time. We can accomplish only one major change truck program in any year." Ford recommended indefinite deferral of a dynamic test requirement for full-size light trucks until the practicability and safety need is established. In the case of compact light trucks, Ford requested that the effective date be delayed until September 1, 1991.

The agency finds good cause for providing additional leadtime. As discussed previously, the agency's test data show that while it is practicable for light trucks and multipurpose passenger vehicles to meet a dynamic test requirement, even in 35 mph barrier impacts, there are a large number of vehicles that must be modified to meet the requirement. Some vehicles, in particular van-type vehicles, may need more extensive structural modifications to meet the dynamic test requirement. Based on the agency's review of the test data, NHTSA believes that in some cases, extensive vehicle modifications may not be necessary. The addition of pre-tensioners to the safety belts (devices that sense a crash and remove slack from the belt system) and additional vehicle padding may enable those vehicles to meet the dynamic test requirement at 30 mph. To address the redesign and manpower issues Ford raised, the agency has decided to adopt a September 1, 1991 effective date. The agency recognizes that some vehicles will be able to comply before that date. However, the additional leadtime is necessary to ensure that all vehicles can be modified by the September 1, 1991 date.

Other Issues Raised by the Commenters

Exclusions from Standard Nos. 203 and 204

Volkswagen suggested that vehicles equipped with dynamically tested manual belts be excluded from Standard Nos. 203, *Impact Protection for the Driver from the Steering Control Systems*, and 204, *Steering Control Rearward Displacement*. The agency does not believe such an exclusion would be appropriate because both those standards have been shown to provide substantial protection to unbelted and belted drivers.

Latching procedure in Standard No. 208

Mercedes-Benz asked that Standard No. 208 be modified to include a test procedure for latching and adjusting a manual safety belt prior to the belt being dynamically tested. NHTSA agrees that Standard No. 208 should include such a procedure and has already adopted such a procedure for dynamically tested manual belts in passenger cars. Subsequent to issuance of that rule, Ford petitioned for reconsideration of the belt latching test procedure. Ford noted that the safety belt positioning procedure specifies applying a 2 to 4 pound tension load to the lap belt of a lap/shoulder belt, but does not specify how the load is to be applied or how the tension is to be measured. Ford asked the agency to clarify the procedure, particularly with regard to whether the load is to be applied to the lap portion of the belt or whether an increasing load is to be placed on the shoulder portion of the belt until the required amount of tension has been reached in the lap portion of the belt.

NHTSA does not believe that the area of application of the belt tension load should have a significant effect on the subsequent performance of the belt in a dynamic test. However, to promote uniformity in application of the load, the agency, on September 5, 1986 (51 FR 31765), amended the standard to provide that the load will be applied to the shoulder portion of the belt adjacent to the latchplate of the belt. If the safety belt system is equipped with two retractors (one for the lap belt and one for the upper torso belt), then the tension load will be applied at the point the lap belt enters the retractor, since the separate lap belt retractor effectively controls the tension in the lap portion of a lap/shoulder belt. The amount of tension will also be measured at the location where the load is applied. Finally, the agency has amended the standard to provide that after the tension load has been applied, the shoulder belt will be positioned flat on the test dummy's shoulder. This will ensure that if the belt is twisted during the application of the tension load, it will be correctly positioned prior to the crash test. This final rule incorporates the same latching procedure for safety belts in light trucks and van-like vehicles.

Revisions to Standard No. 209

The notice proposed to exclude dynamically tested belts from the static laboratory strength tests for safety belt assemblies set forth in S4.4 of Standard No. 209. Ford asked that such belts be

excluded from the remaining requirements of Standard No. 209 as well.

In adopting the dynamic test requirement for lap/shoulder belts in passenger cars, NHTSA agreed that an additional exclusion from some performance requirements of Standard No. 209 is appropriate. The agency noted that the webbing of automatic belts is currently excluded from the elongation and other belt webbing and attachment hardware requirements of Standard No. 209, since those belts have to meet the injury protection criteria of Standard No. 208 during a crash. For dynamically tested manual belts in passenger cars, NHTSA believed that an exclusion from the webbing width, strength and elongation requirements (sections 4.2(a)-(c)) is also appropriate, since these belts will also have to meet the injury protection requirements of Standard No. 208. The agency believes that for those same reasons, dynamically tested safety belts in light trucks and multipurpose passenger vehicles should also be excluded from those requirements of Standard No. 209.

The agency does not believe that manual belts should be excluded from the other requirements in Standard No. 209. For example, the requirements on buckle release force should continue to apply, since manual safety belts, unlike automatic belts, must be buckled every time they are used. As with retractors in automatic belts, retractors in dynamically tested manual belts will still have to meet Standard No. 209's performance requirements.

Subsequent to issuance of the final rule on the dynamic testing of manual safety belts in passenger cars, several organizations petitioned for reconsideration of the exclusion of dynamically tested safety belts in passenger cars from the requirements of Standard No. 209. The agency is still in the process of reviewing those petitions and will respond to them in a later notice. Any changes made for dynamically tested belts in passenger cars will also be made for dynamically tested belts in light trucks and multipurpose passenger vehicles.

Revisions to Standard No. 210

The April 1985 notice proposed that dynamically tested manual belts would not have to meet the location requirements set forth in Standard No., 210, *Seat Belt Assembly Anchorages*. Volkswagen suggested that dynamically tested belts be completely excluded from Standard No. 210: it also recommended that Standard No. 210 be harmonized with Economic Commission for Europe (ECE) Regulation No. 14. AMC and Renault suggested using the "out-of-vehicle" dynamic test procedure for manual belts contained in ECE Regulation No. 16, instead of the proposed barrier crash test in Standard No. 208.

As explained in the final rule adopting the dynamic test requirement for manual safety belts in passenger cars, the agency does not believe that the "out-of-vehicle" laboratory bench test of ECE Regulation No. 16 should be allowed as a substitute for a dynamic vehicle crash test. The protection provided by safety belts depends on the performance of the safety belts themselves, in conjunction with the structural characteristics and interior design of the vehicle. the best way to measure the performance of the safety belt/vehicle combination is through a vehicle crash test.

The agency has recently proposed revisions to Standard No. 210 to harmonize it with ECE Regulation No. 14; therefore the commenters' suggestions concerning harmonization and exclusion of dynamically tested safety belts from the other requirements of Standard No. 210 will be considered during that rulemaking. At the present time, the agency is adopting only the proposed exclusion of anchorages for dynamically tested safety belts from the location requirements, which was not opposed by any commenter.

Belt labeling

Ford objected to the proposal that dynamically tested belts have a label indicating that they may be installed only at the front outboard seating positions of certain vehicles. Ford said that it is unlikely that anyone would attempt to install a lap/shoulder belt in any vehicle other than the model for which it was designed. The agency does not agree and has already adopted a belt labeling requirement for dynamically tested safety belts in passenger cars.

In the final rule on dynamically testing manual safety belts in passenger cars, the agency explained that it believes that care must be taken to distinguish dynamically tested belt systems from other systems, since misapplication of a belt in a vehicle designed for use with a specific dynamically tested belt could pose a risk of injury. If there is a label on the belt itself, a person making the installation will be aware that the belt should be installed only in certain vehicles.

Subsequent to issuance of the passenger car final rule, Ford petitioned for reconsideration of the belt labeling requirement. Ford said that the required label does not specifically identify the safety belt as a dynamically tested belt and the label does not suggest that the belt may be safely used only in specific vehicles at specific seats. Ford asked the agency to rescind the labeling requirement. Ford also suggested that the intent of S4.6(b) could be accomplished by requiring the safety belt installation instruction required by S4.1(k) of the standard to specify both the vehicles for which the belt system is to be used and the specific type of seating position for which it is intended.

As explained in the September 5, 1986 notice responding to Ford's petition for reconsideration, NHTSA believes that it is important that a dynamically tested safety belt be labeled to ensure that it is installed only in the type of vehicle for which it is intended. NHTSA agreed with Ford that providing the information in the installation instructions would address most of the problem of possible misuse. However, there still may be instances where the instruction would be lost. In addition, the installation instruction requirements apply only to aftermarket belts. There can be situations where a safety belt may be taken from one vehicle and transferred to another. Given these considerations and the importance of alerting motorists that a safety belt may have been designed for use in one particular make and model vehicle, the agency decided to retain the labeling requirement.

In response to Ford's comment, NHTSA believes that the statement appearing on the label should be changed to require a manufacturer to specify the specific vehicles for which the safety belt is intended and the specific seating position (e.g., "right front") in which it can be used. In today's final rule, NHTSA is adopting the same belt labeling requirements for light trucks and multipurpose passenger vehicles that it has previously applied to passenger car safety belts.

Cost and benefits

NHTSA has examined the impacts of this rulemaking action and determined that the action is not major within the meaning of Executive Order 12291. It is, however, significant within the meaning of the Department of Transportation's regulatory policies and procedures. The agency has prepared a final regulatory evaluation, which analyzes in detail the economic and other impacts of this rulemaking action. This regulatory evaluation has been placed in Docket No. 74-14; Notice 53. Any interested person may obtain a copy of this regulatory evaluation by writing to: NHTSA Docket Section, Room 5109, 400 Seventh Street, S.W., Washington, D.C. 20590, or by calling the Docket Section at (202) 366-4949.

To briefly summarize the regulatory evaluation, the agency estimates that the dynamic test requirement for manual safety belts will increase testing costs by about $8,500 per test. This cost estimate assumes that manufacturers can conduct the new test as a part of its current crash testing to meet other standards. The additional costs are associated with instrumentation of the dummies. Ford said these tests cannot be "piggy-backed" with those done for FMVSS 212, 219, and 301. Ford stated, "we try to test 'worst case' conditions so that when we pass, we have confidence that all vehicles will pass. But the 'worst case' conditions for one standard may be the 'best case' for another standard." The agency recognizes that it is possible that a worst case test for one standard may not be the same for another standard for a particular vehicle. However, it is also unlikely that for each of the vehicle types covered by this standard it will not be possible to conduct testing to multiple standards, including Standard No. 208, in one crash test.

The agency cannot estimate the design costs associated with meeting the performance requirements adopted in this final rule. As discussed earlier in this notice, some existing vehicle designs currently meet the requirements adopted today. In addition, other vehicles may be able to meet the requirements by adopting different safety belt webbing or retractors, which are relatively minor changes. In other cases, it may be necessary to make structural changes to the vehicle as well to enable the vehicle to meet the performance requirements of the standard.

The agency believes that the rule's requirements will improve the overall level of safety performance provided by light trucks and multipurpose passenger vehicles. As discussed earlier, agency crash testing has shown that the instrumented test dummies in some of these vehicles record comparatively high injury readings in 30 and 35 mph crashes. Today's final rule will ensure that the belt systems and vehicle structure are designed to work together to reduce potential injuries.

Regulatory Flexibility Act

NHTSA has also considered the impacts of this

rulemaking action under the Regulatory Flexibility Act. Today's final rule will have an impact on a large number of small businesses. The potential significance of that impact will differ depending on the type of vehicles currently being used by those businesses and on what actions those manufacturers take in response to today's final rule. The agency has tried to minimize the impact on small businesses, while still improving the safety of the vehicles covered by the amendments adopted today. The impacts on small businesses are discussed briefly below and in more detail in the agency's final regulatory evaluation, which includes a full regulatory flexibility analysis. Persons interested in the regulatory flexibility analysis are urged to review the regulatory evaluation that has been placed in the docket for this final rule.

Few, if any, light truck and multipurpose passenger vehicle manufacturers would qualify as small entities. there is, however, a specialized class of businesses involved in the final stage manufacturing of a vehicle manufactured in two or more stages or involved in the conversion or alteration of new vehicles that would be affected by the restraint system requirements adopted today. Under NHTSA's regulations, a final stage manufacturer must certify that the completed vehicle conforms to all applicable safety standards. In addition, a business that modifies or converts a new vehicle prior to its first sale to a consumer is considered a vehicle alterer under the agency's regulations. As an alterer, the business is required to certify that the vehicle, as altered, continues to comply with all applicable Federal motor vehicle safety standards. For example, a business that installs a body on a new truck chassis or places new seats and other equipment in a van must certify that the vehicle, as altered, continues to comply with all the agency's safety standards.

As discussed earlier in this notice, the agency has reduced the potential impact on those small businesses by limiting the application of today's final rule. In many instances, businesses involved in the final stage manufacturing of a vehicle are adding substantial items of heavy work-performing equipment to a truck chassis. According to the Truck Body and Equipment Association, which represents many final stage manufacturers and vehicle alterers, approximately 90-95 percent of the chassis used by their members involved in final stage manufacturing have a GVWR greater than 8,500 pounds and, in addition, would have an unloaded vehicle weight greater than 5,500 pounds when they are completed. Thus, they would not be covered by the requirement adopted today.

In the case of vehicles that will be covered by the dynamic test requirement, converters and final-stage manufacturers have a number of different alternatives. The manufacturers of the truck or van chassis used by final-stage manufacturers are required to provide information on what center of gravity, weight, and other limitations must be followed for the vehicle to remain in compliance with all the agency's safety standards. Final-stage manufacturers and converters can stay within the limitations prescribed by the original chassis manufacturer and thus the final vehicle will continue to comply. They may also choose to finish the vehicle outside of the limits imposed by the original manufacturer and do the necessary testing or engineering analysis to show that the vehicle still complies with the dynamic test requirement. Finally, in those instances where alterers or final-stage manufacturers have used a vehicle with a GVWR of 8,500 pounds or less or a vehicle with an unloaded vehicle weight of 5,500 pounds or less, they may now choose to switch to vehicles with a greater GVWR or to add more weight to the vehicle so that it is not covered by the requirements adopted today.

Small organizations and governmental units should not be significantly affected. Those entities may be purchasing some altered or multi-stage manufactured vehicles. However, as discussed above, the agency's decision to limit the applicability of the final rule will minimize the cost impact on those vehicles.

In consideration of the foregoing, sections 571.208 and 571.209 of Title 49 of the Code of Federal Regulations are amended as follows:

S4.2 is revised to read as follows:

S4.2 *Trucks and multipurpose passenger vehicles with GVWR of 10,000 pounds or less.*

S4.2.1 *Trucks and multipurpose passenger vehicles with a GVWR of 10,000 pounds or less, manufactured on or after January 1, 1976 and before September 1, 1991.* Each truck and multipurpose passenger vehicle, with a gross vehicle weight rating of 10,000 pounds or less, manufactured before September 1, 1991, shall meet the requirements of S4.1.2.1, or at the option of the manufacturer, S4.1.2.2 or S4.1.2.3 (as specified for passenger cars), except that forward control vehicles manufactured prior to September 1, 1981, convertibles, open-body type vehicles, walk-in van-type trucks, motor homes, vehicles designed to be exclusively sold to the U.S. Postal Service, and vehicles carrying chassis-mount campers may instead meet the requirements of S4.2.1.1 or S4.2.1.2.

S4.2.1.1 *First option—complete automatic protection system.* The vehicle shall meet the crash protection requirements of S5 by means that require no action by vehicle occupants.

S4.2.1.2 *Second option—belt system.* The vehicle shall have seat belt assemblies that conform to Standard 209 installed as follows:

(1) A Type 1 or Type 2 seat belt assembly shall be installed for each designated seating position in convertibles, open-body type vehicles, and walk-in van-type trucks.

(b) In all vehicles except those for which requirements are specified in S4.2.1.2(a), a Type 2 seat belt assembly shall be installed for each outboard designated seating position that includes the windshield header within the head impact area, and a Type 1 or Type 2 seat belt assembly shall be installed for each other designated seating position.

S4.2.2 *Trucks and multipurpose passenger vehicles with a GVWR of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less, manufactured on or after September 1, 1991.* Each truck and multipurpose passenger vehicle, with a gross vehicle weight rating of 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less, manufactured on or after September 1, 1991, shall meet the requirements of S4.1.2.1, or at the option of the manufacturer, S4.1.2.2 or S4.1.2.3 (as specified for passenger cars), except that convertibles, open-body type vehicles, walk-in van-type trucks, motor homes, vehicles designed to be exclusively sold to the U.S. Postal Service, and vehicles carrying chassis-mount campers may instead meet the requirements of S4.2.1.1 or S4.2.1.2. Each Type 2 seat belt assembly installed in a front outboard designated seating position in accordance with S4.1.2.3 shall meet the requirements of S4.6.

S4.2.3 *Trucks and multipurpose passenger vehicles manufactured on or after September 1, 1991 with either a GVWR of more than 8,500 pounds but not greater than 10,000 pounds or with an unloaded vehicle weight greater than 5,500 pounds and a GVWR of 10,000 pounds or less.* Each truck and multipurpose passenger vehicle manufactured on or after September 1, 1991, that has either a gross vehicle weight rating which is greater than 8,500 pounds, but not greater than 10,000 pounds, or has an unloaded vehicle weight greater than 5,500 pounds and a GVWR of 10,000 pounds or less shall meet the requirements of S4.1.2.1, or at the option of the manufacturer, S4.1.2.2 or S4.1.2.3 (as specified for passenger cars), except that convertibles, open-body type vehicles, walk-in van-type trucks, motor homes, vehicles designed to be exclusively sold to the U.S. Postal Service, and vehicles carrying chassis-mount campers may instead meet the requirements of S4.2.1.1 or S4.2.1.2.

3. S4.6 is amended by revising S4.6.2 and adding S4.6.3 to read as follows:

S4.6 *Dynamic testing of manual belt systems.*

S4.6.1 * * *

S4.6.2 Each truck and multipurpose passenger vehicle with a GVWR of 8,500 pounds or less and an unloaded weight of less than 5,500 pounds that is manufactured on or after September 1, 1991, and is equipped with a Type 2 seat belt assembly at a front outboard designated seating position pursuant to S4.1.2.3 shall meet the frontal crash protection requirements of S5.1 at those designated seating positions with a test dummy restrained by a Type 2 seat belt assembly that has been adjusted in accordance with S7.4.2. A vehicle shall not be deemed to be in noncompliance with this standard if its manufacturer establishes that it did not have reason to know in the exercise of due care that such vehicle is not in conformity with the requirement of this standard.

S4.6.3 A Type 2 seat belt assembly subject to the requirements of S4.6.1 or S4.6.2 of this standard does not have to meet the requirements of S4.2(a)-(c) and S4.4 of Standard No. 209 (49 CFR 571.209) of this Part.

4. S5.1 is revised to read as follows:

S5. *Occupant crash protection requirements.*

S5.1 Passenger cars manufactured before September 1, 1991, and all other vehicles subject to S5.1 shall comply with either S5.1(a) or S5.1(b), at the manufacturer's option. Passenger cars manufactured on or after September 1, 1991, shall comply with S5.1(b). * * * * *

5. S7.4.4 is revised to read as follows:

S7.4 *Seat belt comfort and convenience* * * * *

S7.4.4 *Latchplate access.* Any seat belt assembly latchplate that is located outboard of a front outboard seating position in accordance with S4.1.2 shall also be located within the outboard reach envelope of either the outboard arm or the inboard arm described in S10.6 of this standard and, in the case of a Part 572 Subpart B test dummy, Figure 3A of this standard, or, in the case of a Part 572 Subpart E test dummy, Figure 3B of this standard, when the latchplate is in its normal stowed position. There shall be sufficient clearance between the vehicle seat and the side of the vehicle interior to allow the test block defined in Figure 4 of this standard unhindered transit to the latchplate or buckle. * * * * *

6. S10.6.1 is revised to read as follows:

S10.6 * * *

S10.6.1 *Driver's position.* Move the upper and the lower arms of the test dummy at the driver's position to their fully outstretched position in the lowest possible orientation. Push each arm rearward permitting bending at the elbow, until the palm of each hand contacts the outer part of the rim of the steering wheel at its horizontal centerline. Place the test dummy's thumbs over the steering wheel rim and position the upper and lower arm centerlines as close as possible in a vertical plane without inducing torso movement. The thumbs shall be over the steering wheel rim and lightly taped to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 2 pounds and not more than 5 pounds, the tape shall release the hand from the steering wheel rim. * * * * *

7. S11 is amended by revising S11.1, S11.3.1, S11.5, and S11.6, to read as follows:

S11 *Positioning procedure for the Part 572 Subpart E Test Dummy.* * * *

S11.1 *Head.* The transverse instrumentation platform of the head shall be horizontal within 1/2 degree. To level the head of the test dummy in vehicles with upright seats with non-adjustable backs, the following sequences must be followed. First adjust the position of the H-point within the limits set forth in S11.4.3.1 to level the transverse instrumentation platform of the head of the test dummy. If the transverse instrumentation platform of the head is still not level, then adjust the pelvic angle of the test dummy within the limits provided in S11.4.3.2 of the standard. If the transverse instrumentation platform of the head is still not level, then adjust the neck bracket of the test dummy the minimum amount necessary to ensure that the transverse instrumentation platform of the head is horizontal within 1/2 degree. * * * * *

S11.3 *Hands.*

S11.3.1 The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centerline. The thumbs shall be over the steering wheel rim and shall be lightly taped to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 2 pounds and not more than 5 pounds, the tape shall release the hand from the steering wheel rim. * * * * *

S11.5 *Legs.*

S11.5.1 The legs of the driver and passenger dummy shall be plasced as provided in S11.5.2 or, at the option of the vehicle manufacturer until September 1, 1991, as provided in S10.1.1 for the driver and S10.1.2 for the passenger, except that the initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches for both the driver and the passenger rather than 14 1/2 inches as specified in S10.1.1 (a) for the driver and 11 3/4 inches as specified in S10.1.2.1(a) and S10.1.2.2(a) for the passenger.

S11.5.2 The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches. To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. To the extent practicable, the right leg of the driver dummy shall be in a vertical plane. Final adjustment to accommodate placement of feet in accordance with S11.6 for various passenger compartment configurations is permitted.

S11.6 *Feet.*

S11.6.1 The feet of the driver test dummy shall be placed as required by S11.6.2 or, at the option of the vehicle manufacturer until September 1, 1991, as provided in S10.1.1. The feet of the passenger test dummy shall be placed as required by S11.6.3 or, at the option of the vehicle manufacturer until September 1, 1991, as provided in S10.1.2.

S11.6.2 The right foot of the driver test dummy shall rest on the undepressed accelerator with the rearmost point of the heel on the floor surface in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be positioned perpendicular to the tibia and placed as far forward as possible in the direction of the centerline of the pedal with the rearmost point of the heel resting on the floor surface. The heel of the left foot shall be placed as far forward as possible and shall rest on the floor pan. The left foot shall be positioned as flat as possible on the toeboard. The longitudinal centerline of the left foot shall be placed as parallel as possible to the longitudinal centerline of the vehicle.

S11.6.3 The heels of both feet of the passenger test dummy shall be placed as far forward as possible and shall rest on the floor pan. Both feet shall be positioned as flat as possible on the toeboard. The longitudinal centerline of the feet shall be placed as parallel as possible to the longitudinal centerline of the vehicle. * * * * *

8. Figure 3 following the test of §571.208 is removed and new Figures 3A and 3B are inserted in its place, appearing as follows:

§571.209 [AMENDED]

9. S4.6 of §571.209 is revised to read as follows:

S4.6 *Manual belts subject to crash protection requirements of Standard No. 208.*

(a) A seat belt assembly subject to the requirements of S4.6 of Standard No. 208 (49 CFR §571.208) does not have to meet the requirements of S4.2(a)-(c) and S4.4 of this standard.

(b) A seat belt assembly that meets the requirements of S4.6 of Standard No. 208 (49 CFR §571.208) shall be permanently and legibly marked or labeled with the following statement:

The dynamically-tested seat belt assembly is for use only in (insert specific seating position(s)), e.g., "front right") n (insert specific vehicle make(s) and model(s)).

Issued on: November 18, 1987

Diane K. Steed
Administrator

52 F.R. 44898
November 23, 1987

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Seat Belt Assemblies

(Docket No. 74-14; Notice 71)
RIN 2127-AD11

ACTION: Final rule.

SUMMARY: This agency has expressed its intention to exclude safety belts that meet dynamic testing requirements from some of the static testing requirements to which all safety belts are subject. Dynamic testing consists of a 30 mile per hour crash test of the vehicle using test dummies as surrogates for human occupants. Since the dynamic test measures the actual occupant protection which the belt provides during a crash, there is no apparent need to subject that belt to static testing procedures that are surrogate and less direct measures of the protection which the belt would provide to its occupant during a crash.

In order to avoid needless regulatory restrictions on safety belts that have been dynamically tested, this rule amends the agency's regulations to more accurately express the scope of the exemption from the static testing requirements for safety belts that are dynamically tested. Specifically, this rule:

1. Excludes *all* safety belts that are subject to the dynamic testing requirements, regardless of the type of vehicle in which those belts are installed, from some of the static testing requirements for safety belts;

2. Permits the use of load limiters on *all* safety belts installed at seating positions subject to the dynamic testing requirements, regardless of whether the subject belts are automatic or manual safety belts; and

3. Correctly identifies *all* of the static testing requirements from which automatic safety belts and manual safety belts subject to the dynamic testing requirements are excluded in the safety standards, instead of listing some of those requirements in the safety standards, and adding others in the agency's interpretations and preambles to rules.

This notice also clarifies which safety belts the agency was referring to when it described safety belts as "dynamically tested." NHTSA was referring only to all automatic belts and to manual safety belts that are the only occupant restraint system at a seating position. Thus, any manual safety belts installed at seating positions also equipped with either an automatic safety belt or an air bag are not "dynamically tested" safety belts within the meaning of this rule. Such manual safety belts are, therefore, subject to the strength, webbing width, and other requirements of Standard No. 209. However, this rule excludes manual safety belts installed at seating positions also equipped with either an automatic safety belt or an air bag from the elongation requirements of Standard No. 209. This exclusion will allow maximum engineering flexibility in the design of these manual belt systems, while still ensuring effective occupant protection.

EFFECTIVE: April 16, 1991.

BACKGROUND: Standard No. 209, Seat Belt Assemblies (49 CFR § 571.209), sets forth qualities of the webbing and hardware used in a seat belt assembly, along with some additional tests of the seat belt assembly as a whole. Absent a dynamic test, these tests individually evaluate each of the aspects of a belt system that NHTSA believes are necessary to ensure that the belt system will provide adequate occupant protection in a crash. For instance, the strength requirements in Standard No. 209 are intended to ensure that the safety belt is strong enough to withstand the loads imposed by a person using the belt in a crash; the webbing elongation requirements help ensure that the belt will not stretch so much that it provides a lesser level of protection, and so forth. NHTSA assumes that any belt system that achieves the required level of performance in all of these tests will offer adequate occupant protection when the belt system is installed in any vehicle at any seating position.

However, NHTSA has long believed it more appropriate to evaluate the occupant protection afforded by vehicles by conducting dynamic testing, which consists of a crash test of the vehicle using test dummies as surrogates for human occupants. This belief is based on the fact that the protection provided by safety belts

depends on *more* than the performance of the safety belts themselves or of belt components tested individually. Occupant protection depends on the performance of the safety belts themselves *and* the structural characteristics and interior design of the vehicle. A dynamic test of the vehicle allows NHTSA to evaluate *all* of the factors that affect occupant crash protection. Further, a dynamic test allows the agency to evaluate the synergistic effects of *all* these factors working together, instead of evaluating each factor individually. Finally, a dynamic test assesses the vehicle's capabilities for minimizing the risk of injury as measured by test dummies and human-based injury criteria, as opposed to individual belt component tests that are only indirectly related to human injury risk.

For dynamic testing under Standard No. 208, Occupant Crash Protection (49 CFR § 571.208), test dummies are placed in the vehicle and the vehicle is subjected to a frontal crash into a concrete barrier at a speed of 30 miles per hour (mph). In evaluating the occupant crash protection capabilities of a vehicle, this dynamic test assesses safety belt performance. A requirement for safety belts to conform to both the dynamic testing requirements of Standard No. 208 and the laboratory testing requirements of Standard No. 209 is thus unnecessary, because Standard No. 208 dynamic testing would evaluate the critical aspects of belt and assembly performance that would be evaluated under Standard No. 209. To avoid such redundancies, automatic safety belts subject to the dynamic testing requirements of Standard No. 208 were excluded from Standard No. 209's laboratory testing requirements for webbing, attachment hardware, and assembly performance shortly after NHTSA established the first dynamic testing requirements in Standard No. 208. *See* 36 FR 23725. December 14, 1971.

More recently, NHTSA has extended the dynamic testing requirements of Standard No. 208 to manual safety belt systems installed at the front outboard seating positions in passenger cars (51 FR 9800; March 21, 1986) and light trucks and multipurpose passenger vehicles (52 FR 44898; November 23, 1987). In both instances, the agency stated in the preamble to the rule that dynamically tested manual belts should be excluded from the same requirements of Standard No. 209 as automatic belts are, for the same reasons. *See* 51 FR 9804; 52 FR 44906. On the other hand, both automatic and dynamically tested manual belts are subject to other requirements in Standard No. 209; for example, the retractor performance requirements, the buckle release mechanism performance requirements, and the requirements for corrosion resistance of attachment hardware apply to these types of safety belts. NHTSA subsequently denied petitions for reconsideration and a petition for rulemaking on the question of excluding dynamically tested safety belts from some of the requirements of Standard No. 209. *See* 53 FR 5579; February 25, 1988. In the denial notice, NHTSA reemphasized its conclusion that there was no safety or other need to justify applying some of the static tests in Standard No. 209 to belt systems that have been dynamically tested in the vehicle in which they are installed.

In addition, the preambles to the rules establishing dynamic testing of some manual safety belt systems in passenger cars and light trucks and multipurpose passenger vehicles stated that dynamically tested manual safety belts should be labeled indicating the seating positions and particular vehicles in which these safety belts could be installed. *See* 51 FR 9804; 52 FR 44906-44907. These labels were intended to minimize the likelihood that a dynamically tested safety belt would be installed in a vehicle or a seating position for which it was not intended. NHTSA subsequently denied a petition for rulemaking asking that these labeling requirements be amended to apply *only* to dynamically tested manual belt systems that did not comply with all the static testing requirements of Standard No. 209. 53 FR 50429; December 15, 1988.

However, the regulatory language in Standards No. 208 and 209 did not fully and clearly achieve the agency's expressed intentions. Therefore, the agency proposed to amend the provisions of those standards in four areas in a notice of proposed rulemaking (NPRM) published on January 18, 1990 (55 FR 1681). NHTSA received six comments on this NPRM. Commenters included motor vehicle manufacturers, safety belt manufacturers, and motor vehicle dealers. All of these comments were considered in developing this final rule, and the most significant comments are discussed below. For the convenience of the reader, this rule uses the same organization as the NPRM.

1. *Exclusion for Dynamically Tested Manual Belt Systems Installed in Passenger Cars from Certain Requirements of Standard No. 209.*

Volkswagen of America (Volkswagen) submitted a petition asking NHTSA to amend the language in Standard No. 208 so as to achieve the agency's stated intent of excluding dynamically tested manual belt assemblies installed at front outboard seating positions of passenger cars from the webbing width, strength, and elongation requirements of Standard No. 209. Volkswagen noted that, although preambles to rules on dynamic testing have repeatedly indicated that NHTSA was excluding dynamically tested manual belts in passenger cars from certain static testing requirements of Standard No. 209, the current language in section S4.6.1 of Standard No. 208 excludes dynamically tested manual belts in passenger cars from some requirements in Standard No. 209 *only if* the requirement for automatic restraints in passenger cars were rescinded. Since there was no rescission, there

is currently no exclusion from any of the requirements in Standard No. 209 for dynamically tested manual belts in passenger cars.

In the NPRM, NHTSA repeated its previous statements that it is appropriate to exclude all belt systems subject to dynamic testing requirements, including dynamically tested manual belts in passenger cars, from some of the static testing requirements of Standard No. 209. The failure to provide such an exclusion in Standard No. 208 was simply an oversight on NHTSA's part. The agency proposed to correct that oversight in the NPRM.

Chrysler, Ford, and BMW commented that they supported this proposal. The Automotive Occupant Restraints Council (AORC) opposed the proposal. According to AORC, excluding dynamically tested manual belts from some of the static testing requirements in Standard No. 209 might result in adverse safety consequences. For example, AORC noted that the static webbing strength test exposes the webbing to loading that is approximately twice as great as the most heavily-loaded webbing would be exposed to during dynamic testing. This commenter asserted that an "unknowledgeable or reckless" manufacturer could introduce webbing of lesser strength in its dynamically tested safety belts and that this webbing of lesser strength would be a "degraded occupant crash protection product." Similarly, AORC suggested that eliminating the assembly performance requirements for dynamically tested safety belts "could result in a degradation of performance of the seat belt assembly." In the same vein, AORC suggested that elimination of the webbing width requirements for dynamically tested safety belts "would provide the possibility for ill-conceived, unproven significant deviations" from the webbing width specified in Standard No. 209.

AORC had previously raised these concerns about excluding dynamically tested manual belts from some of the static testing requirements of Standard No. 209. NHTSA responded in detail in a February 25, 1988 notice (53 FR 5579). To briefly repeat that response, the agency agreed with AORC that the static testing provisions of Standard No. 209 are well-conceived provisions that have assured adequate levels of occupant crash protection. The agency also agreed that the static testing provisions of Standard No. 209 subject the safety belt to higher force levels than are generally encountered in dynamic testing under Standard No. 208. Thus, it is possible that safety belt manufacturers could make design changes to their dynamically tested manual safety belts that might result in lesser safety protection for belt users. The agency stated that it must determine if this possible action by safety belt manufacturers is sufficiently likely so as to justify some preventive regulatory action.

Automatic belts have been excluded from these static testing requirements since 1971. In those 20 years, NHTSA has no evidence of *any* instances where automatic safety belts provided any lesser level of safety protection because those belts are excluded from some of the static tests in Standard No. 209. Judging from this record, it seems that the possibility that safety belt manufacturers would take actions that would result in lesser safety protection has not become a reality, in the case of automatic safety belts. There is no apparent reason to believe that this possibility would become a reality in the case of dynamically tested manual belts, and AORC did not suggest such a reason. Hence, there is no apparent need for the static testing requirements in Standard No. 209 to apply to dynamically tested manual safety belts.

In addition to these previously expressed reasons for excluding dynamically tested manual safety belts in general from some of Standard No. 209's static tests, NHTSA believes there is an additional reason to adopt the proposal to exclude dynamically tested manual safety belts in passenger cars from those static tests. Dynamically tested manual safety belts in light trucks are already excluded from those static tests. There is no reason to treat dynamically tested manual safety belts differently, depending on the type of vehicle in which those belts are installed. The differing treatment arose because of an oversight on the agency's part. The adoption of the proposal to treat all dynamically tested manual safety belts in the same way for the purposes of some static testing requirements in Standard No. 209 corrects that oversight.

NHTSA would also like to respond to a point raised in Ford's comments. Ford suggested that manual safety belts installed at seating positions equipped with an air bag could be considered dynamically tested manual safety belts, or a "manual seat belt assembly subject to the requirements of S5.1" of Standard No. 208, as expressed in the proposed regulatory language. Ford correctly noted that S4.1.2.1(a) requires that air bags provide acceptable occupant crash protection in a 30 mph barrier crash test by automatic means alone. S4.1.2.1(c)(2), which requires that manual safety belts be installed at seating positions equipped with air bags, also requires that the seating position provide acceptable occupant protection in another 30 mph barrier crash test with the manual safety belts fastened. According to Ford, this testing meant that the manual safety belts at seating positions equipped with air bags are, strictly speaking, "subject to the requirements of S5.1" and that those belts could be considered dynamically tested manual safety belts. This interpretation is contrary to NHTSA's intent. The safety belts that NHTSA meant to describe as subject to the crash testing requirements of S5.1 included all automatic belts and manual safety belts that were the only occupant

restraint system at a seating position. Thus, any manual belts installed at seating positions also equipped with either automatic safety belts or air bags are not what NHTSA is referring to when it uses the term "dynamically tested manual belts" in preambles or letters of interpretation. To make this clear, the regulatory language adopted in this final rule describes the excluded safety belts as "any manual seat belt assembly subject to the requirements of S5.1 of this standard by virtue of any provision of this standard other than S4.1.2.1(c)(2)."

A result of this clarification is that manual safety belts installed at seating positions also equipped with either automatic safety belts or air bags will remain subject to Standard No. 209's requirements for webbing width, strength, and so forth. This helps ensure that the manual safety belts will provide the intended occupant protection in situations in which the automatic crash protection is not intended to deploy (e.g., in crashes other than frontal crashes and rollovers).

However, the agency believes it is appropriate to exclude manual belts installed at seating positions also equipped with either automatic belts or air bags from the elongation requirements in Standard No. 209. NHTSA concludes that allowing an exclusion from the elongation requirements for these safety belts will permit safety belt designs that optimize the belt force deflection characteristics of the manual belts installed in conjunction with automatic crash protection systems. Optimized designs could achieve better occupant protection. Appropriate amendments have been made to Standards No. 208 and 209 to reflect this exclusion.

2. *Load Limiters on Dynamically Tested Manual Belts.*

Ford filed a petition for rulemaking asking that "load limiters" be permitted on dynamically tested manual safety belts. S4.5 of Standard No. 209 includes specific regulatory provisions regarding "load limiters" on safety belt systems. A "load limiter" is defined in section S3 of Standard No. 209 as "a seat belt assembly component or feature that controls tension on the seat belt to modulate the forces that are imparted to occupants restrained by the belt assembly during a crash." Before this rule takes effect, the language of S4.5 of Standard No. 209 allows load limiters to be used on belt assemblies *only* if that belt assembly is part of an automatic restraint system.

However, the agency explained in the NPRM that it agreed with Ford's suggestion that the agency intended to permit the use of load limiters on dynamically tested manual belt systems. As long as a belt system is installed at a seating position that is subject to dynamic testing requirements, the occupant protection capabilities of the belt system can be evaluated in the dynamic testing. There is no reason to permit the use of load limiters on dynamically tested automatic belt systems, but prohibit their use on dynamically tested manual belt systems. Accordingly, the NPRM proposed to amend S4.5 of Standard No. 209 to allow load limiters to be used on belt systems installed in conjunction with an automatic restraint system *or* on belt systems installed at a seating position subject to the dynamic testing requirements.

Chrysler and Ford supported this proposal, and no commenters objected to the proposal. The proposed change is made in this final rule, for the reasons set forth in the proposal.

As an adjunct to the proposal to allow load limiters on belt systems installed at a seating position equipped with automatic crash protection, the agency proposed to require those belt systems to be labeled in the same way as automatic belts equipped with load limiters. Ford commented that it did not believe that labeling of dynamically tested safety belts is necessary, irrespective of whether the dynamically tested safety belt is manual or automatic. Thus, Ford asked that the proposed labeling requirement for dynamically tested safety belts with load limiters not be adopted in this final rule. NHTSA proposed to require dynamically tested manual safety belts equipped with load limiters to be labeled in the same way that dynamically tested automatic belts with load limiters have been required to be labeled since 1981. Prior to Ford's comment, NHTSA had not heard of any suggestion that the labeling requirements for automatic belts with load limiters were unduly burdensome, onerous, confusing, or the like. During this rulemaking, no commenter other than Ford made such a suggestion. Thus, absent some further explanation of the difficulties Ford has experienced, NHTSA does not believe that extending the existing labeling requirements for automatic belts with load limiters to dynamically tested manual belts with load limiters will result in any undue burdens for manufacturers or consumers.

Ford also stated its understanding that the labeling requirements in the proposal would apply to automatic and dynamically tested manual belts only if those belt assemblies: (1) incorporated a load limiter, *and* (2) did not comply with the elongation requirements in Standard No. 209.

Based on this understanding, Ford asked the agency to confirm that NHTSA had not proposed to require labeling of dynamically tested safety belts that include load limiters, but still comply with the elongation requirements in Standard No. 209. Ford's understanding is correct. There is no need to specifically label safety belts that use load limiters, but nevertheless comply with the elongation requirements of Standard No. 209.

After considering the comments, the agency is adopting the proposed labeling requirement for safety belts that incorporate load limiters, with two minor modifi-

cations. First, the agency proposed to require that safety belts with load limiters be labeled with information describing the belt system as "dynamically tested." That phrase has been deleted from the required label information in this final rule, to reflect the facts that load limiters may be used on manual belt systems installed at seating positions also equipped with air bags and that those belt systems are not what NHTSA means by "dynamically tested manual belts" as explained in the preceding section of this preamble.

Second, the agency proposed to permit load limiters to be installed on "Type 1 or Type 2 seat belt assemblies," if the safety belt were installed at a seating position subject to dynamic testing. Strictly speaking, an automatic safety belt is not a Type 1 or Type 2 seat belt assembly. Thus, notwithstanding NHTSA's express intention to permit load limiters on automatic belts, the proposed regulatory language would not clearly have done so. This final rule deletes the references to Type 1 or Type 2 seat belt assemblies from the regulatory language.

3. *Scope of Exclusion from Standard No. 209 for Dynamically Tested Manual Belt Systems.*

Before the effective date of this rule, both Standards No. 208 and 209 exclude dynamically tested manual belt systems from "the requirements of S4.2(a)-(c) and S4.4" of Standard No. 209. However, while this exclusion appears to be a comprehensive listing of the provisions of Standard No. 209 from which dynamically tested safety belts are excluded, it is in fact incomplete. Several previous interpretations and preambles to rulemaking actions have expressed NHTSA's position that dynamically tested manual belt systems are excluded from the requirements of S4.2 (d)-(f), as well as the listed sections of Standard No. 209. The NPRM proposed to amend Standard No. 209 so that it would correctly show all of the provisions of Standard No. 209 from which dynamically tested manual belt systems were excluded. The commenters supported this proposal. It is adopted for the reasons set forth in the NPRM.

4. *Labeling Requirements for Dynamically Tested Manual Safety Belts Installed in Passenger Cars.*

At this time, Standard No. 209 requires information about the vehicles and seating positions in which dynamically tested belt systems can be installed, to be labeled on dynamically tested manual belt systems for use in light trucks and multipurpose passenger vehicles. However, Standard No. 209 currently does *not* require any installation information to be labeled on dynamically tested manual belt systems for use in passenger cars. The agency proposed in the NPRM to remedy this inconsistency by revising Standard No. 209 so that it would require installation information to be labeled on *all* dynamically tested manual belt systems, regardless of the vehicle type in which the belt system will be installed.

This proposal drew the most attention from the commenters. The National Automobile Dealers Association (NADA) supported this proposal, stating that a consistent labeling requirement for safety belts would "certainly benefit" aftermarket installations of those safety belts. On the other side of this issue, Chrysler opposed the proposal, asserting that the proposed requirement would be cumbersome, and not necessary to ensure proper safety belt replacement and performance. Chrysler asserted that it currently has over 300 replacement safety belt part numbers for its 1990 vehicles alone. Because of this complexity and proliferation of parts, Chrysler asserted that dealers and garages do not usually stock replacement safety belts, but order the belts and parts from Chrysler when needed. Accordingly, Chrysler believed that the proposed labeling requirement would not serve any purpose.

Ford also opposed the proposal. According to Ford, dynamically tested safety belts are so complex that it would be extremely difficult to mistakenly install a dynamically tested safety belt in a vehicle or at a seating position other than that for which it is designed. Given this difficulty, Ford argued that it was very unlikely that such an installation could be done inadvertently. Ford suggested that the information proposed to be required to appear on a label on the belt instead be required to appear in the installation instructions required to be provided with safety belt assemblies. BMW and the Automobile Importers Association submitted comments that were substantially similar to the Chrysler and Ford comments.

NHTSA has reconsidered the proposed labeling requirements in response to these comments. On the one hand, the agency does not believe there is any reason to have different labeling requirements for dynamically tested manual belt assemblies to be used in passenger cars than for dynamically tested manual belt assemblies to be used in light trucks. The likelihood that dynamically tested manual safety belts will be inadvertently installed in vehicles or seating positions other than those for which the belts were designed would not differ, depending upon the type of vehicle in which the dynamically tested belt is to be used. The proposal to extend the same labeling requirements that currently apply to dynamically tested manual belts for use in light trucks to dynamically tested manual belts for use in passenger cars was an effort by the agency to ensure that the labeling requirements were consistent.

On the other hand, NHTSA does not want to impose an unnecessary or burdensome labeling requirement. The agency would like to further explore the idea of addressing the inappropriate installation of dynamically tested manual safety belts by means of the in-

structions already required to be furnished with safety belts by S4.1(k) of Standard No. 209. If the installation instructions were required to set forth the information currently required to be labeled on dynamically tested manual safety belts, it would seem that persons installing replacement safety belts would always have access to the information, just as they would if the information were labeled on the safety belt. The only instances in which information might not be available to the installer would be if the installation instructions were lost or if the installer was removing a safety belt from one vehicle and transferring the belt to another vehicle. NHTSA has no indications that either of these events are common occurrences.

To allow for further exploration of this subject, NHTSA plans to initiate a rulemaking action proposing to require that the information currently required to be labeled on dynamically tested manual belts for use in light trucks instead be required to be provided in the installation instructions for all dynamically tested safety belts, both automatic and manual. This proposed requirement would apply to dynamically tested safety belts for use in both passenger cars and light trucks.

Until the agency has completed this planned rulemaking, it would be premature to make any change to the existing requirements for labeling dynamically tested safety belts. Hence, the labeling requirements for dynamically tested manual belts for use in light trucks that are now in place will remain in effect. However this final rule does not adopt the proposed extension of the labeling requirements for dynamically tested light truck manual safety belts to also cover dynamically tested manual safety belts for use in passenger cars.

This final rule operates to relieve some unintended restrictions on the use of dynamically tested safety belts by adopting regulatory language that reflects the agency's intention, as expressed in preambles of various rules. No additional duties or responsibilities are imposed on any party as a result of these modifications to the regulatory language. Accordingly, NHTSA finds for good cause that these modifications should become effective upon publication in the *Federal Register*.

Rulemaking Analyses and Notices

Executive Order 12291 (Federal Regulation) DOT Regulatory Policies and Procedures

NHTSA has considered the impacts of this rulemaking action and determined that it is neither major within the meaning of Executive Order 12291 nor significant within the meaning of the Department of Transportation's regulatory policies and procedures. The amendments made in this notice will give manufacturers additional freedom to design and install manual belts in any way that ensures adequate protection for the user in the event of a crash. To the extent that the former language in Standards No. 208 and 209 did not accurately reflect the agency's intended requirements for dynamically tested safety belts. the former language imposed some insignificant, but unnecessary, costs on vehicle manufacturers. This rule eliminates those needless costs.

In consideration of the foregoing, 49 CFR Part 571 is amended as follows:

(1) S4.6 of Standard No. 208 is amended by removing existing sections S4.6.1 and S4.6.3, redesignating existing S4.6.2 as S4.6.1, and adding new sections S4.6.2 and S4.6.3 to read as follows:

S4.6 *Dynamic testing of manual belt systems.*

* * * * *

S4.6.2 Any manual seat belt assembly subject to the requirements of S5.1 of this standard by virtue of a y provision of this standard other than S4.1.2 1(c)(2) does not have to meet the requirements of S4.2(a)-(f) and S4.4 of Standard No. 209 (§ 571.209).

S4.6.3 Any manual seat belt assembly subject to the requirements of S5.1 of this standard by virtue of S4.1.2.1(c)(2) does not have to meet the elongation requirements of S4.2(c), S4.4(a)(2), S4.4(b)(4), and S4.4(b)(5) of Standard No. 209 (§ 571.209).

* * * * *

§ 571.209 [Amended]

(2) S4.5 of Standard No. 209 is amended by revising S4.5(b) and (c) to read as follows:

S4.5 *Load-limiter.*

* * * * *

(b) A seat belt assembly that includes a load limiter and that does not comply with the elongation requirements of this standard may be installed in motor vehicles at any designated seating position that is subject to the requirements of S5.1 of Standard No. 208 (§ 571.208).

(c) A seat belt assembly that includes a load limiter and that does not comply with the elongation requirements of this standard shall be permanently and legibly marked or labeled with the following statement:

> This seat belt assembly is for use only in [insert specific seating position(s), e.g., "front right"] in [insert specific vehicles make(s) and model(s)].

S4.6(a) of Standard No. 209 is revised to read as follows:

S4.6 *Manual belts subiect to crash protection requirements of Standard No. 208.*

(a)(1) A manual seat belt assembly, which is subject to the requirements of S5.1 of Standard No. 208 (49 CFR § 571.208) by virtue of any provision of Standard No. 208 other than S4.1.2.1(c)(2) of that standard, does

not have to meet the requirements of S4.2(a)-(f) and S4.4 of this standard.

(2) A manual seat belt assembly subject to the requirements of S5.1 of Standard No. 208 (49 CFR § 571.208) by virtue of S4.1.2.1(c)(2) of Standard No. 208 does not have to meet the elongation requirements of S4.2(c), S4.4(a)(2), S4.4(b)(4), and S4.4(b)(5) of this standard.

*　　*　　*　　*　　*

Issued on April 10, 1991

Jerry Ralph Curry
Administrator

56 F.R. 15295
April 16, 1991

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 209

Occupant Crash Protection; Seat Belt Assemblies

(Docket No. 74-14; Notice 72)
RIN: 2127-AE26

ACTION: Response to petitions for reconsideration; Final rule.

SUMMARY: NHTSA recently published a final rule to express more accurately the static testing requirements for safety belts that do not apply to automatic belts or to manual belts that are crash tested. In response to petitions for reconsideration of that final rule, this rule clarifies the scope of the labeling requirement for crash tested manual belts and modifies that labeling requirement to make it identical to the labeling requirement for safety belts with load limiters. These amendments will improve the clarity of the labeling requirements and avoid needless burdens on manufacturers.

EFFECTIVE DATE: These amendments take effect September 1, 1992. Safety belts and vehicles manufactured before September 1, 1992 may comply with the post-September 1, 1992 requirements for belt labeling.

SUPPLEMENTARY INFORMATION:

Background

Standard No. 209, Seat Belt Assemblies (49 CFR § 571.209), sets forth a series of static tests for strength and other qualities of the webbing and hardware used in a seat belt assembly, along with some additional tests of the seat belt assembly as a whole. Absent a dynamic test, these tests individually evaluate each of the aspects of a belt system that NHTSA believes are necessary to ensure that the belt system will provide adequate occupant protection in a crash. For instance, the strength requirements in Standard No. 209 are intended to ensure that the safety belt is strong enough to withstand the loads imposed by a person using the belt in a crash; the webbing elongation requirements help ensure that the belt will not stretch so much that it provides a lesser level of protection; and so forth. NHTSA believes that any belt system that achieves the required level of performance in all of these tests will offer adequate occupant protection when the belt system is installed in any vehicle at any seating position.

However, NHTSA has long believed it more appropriate to evaluate the occupant protection afforded by vehicles by conducting dynamic testing, which consists of a crash test of the vehicle using test dummies as surragates for human occupants. This belief is based on the fact that the protection provided by safety belts depends on more than the performance of the safety belts themselves or of belt components tested individually. Occupant protection depends on not only the performance of the safety belts themselves but the structural characteristics and interior design of the vehicle. A dynamic test of the vehicle allows NHTSA to evaluate all of the factors that affect occupant crash protection. Further, a dynamic test allows the agency to evaluate the synergistic effects of all these factors working together, instead of evaluating each factor individually. Finally, a dynamic test assesses the vehicle's capabilities for minimizing the risk of injury as measured by test dummies and human-based injury criteria, as opposed to individual belt component tests that are only indirectly related to human injury risk.

For dynamic testing under Standard No. 208, Occupant Crash Protection (49 CFR 571.208), test dummies are placed in the vehicle and the vehicle is subjected to a frontal crash into a rigid barrier at a speed of 30 miles per hour (mph). In evaluating the occupant crash protection capabilities of a vehicle, this dynamic test also assesses safety belt performance. A requirement for safety belts to conform to both the dynamic testing requirements of Standard No. 208 and certain laboratory testing requirements of Standard No. 209 is thus unnecessary, because Standard No. 208 dynamic testing would evaluate the critical aspects of belt and assembly performance that would be evaluated under Standard No. 209. To avoid such redundancies, automatic safety belts subject to the dynamic testing requirements of Standard No. 208 were excluded from Standard No. 209's laboratory testing requirements for webbing, attachment hardware, and assembly performance shortly after NHTSA established the first dynamic testing requirements in Standard No. 208. See 36 FR 23725; December 14, 1971.

April 1991 Final Rule

On April 16, 1991, NHTSA published a final rule amending Standards No. 208 and 209 to avoid unnecessary regulatory restrictions on safety belts that have been dynamically tested (56 FR 15295). That final rule amended that agency's regulations to express more accurately the scope of the exemption from the static testing requirements for safety belts that are dynamically tested.

Specially, that rule:

1. Excluded all safety belts that are subject to the dynamic testing requirements, regardless of the type of vehicle in which those belts are installed, from some of the static testing requirements for safety belts (e.g., webbing width, strength, and elongation);

2. Permitting the use of load limiters on all safety belts installed at seating positions subject to the dynamic testing requirements, regardless of whether the subject belts are automatic or manual safety belts; and

3. Identified all of the static testing requirements from which automatic safety belts and manual safety belts subject to the dynamic testing requirements are excluded in the safety standards, instead of listing some of those requirements in the safety standards and adding others in the agency's interpretations and preambles to rules.

Petition for Reconsideration

The final rule also more clearly identified the safety belts to which the agency is referring when it describes safety belts as "dynamically tested."

In response to the final rule, NHTSA received petitions for reconsideration from Ford and Volkswagen of America (Volkswagen). This notice responds to the issues raised in the those petitions.

1. *Whether the April 16 Rule Also Applies to Standard No. 210*

In its petition for reconsideration, Ford was concerned that the final rule's clarification of the term "dynamically tested belts" for the purposes of Standards No. 208 and 209 might be interpreted to apply to Standard No. 210 as well. Ford was particularly concerned that a manual belt provided at a seating position also equipped with an air bag might no longer be excluded from the anchorage location requirements set forth in S4.3 of Standard No. 210. Ford asked NHTSA to verify that the interpretation of which manual belts are considered "dynamically tested" manual belts for the purposes of Standards No. 208 209 is limited to those standards, and did not affect the differing interpretation the agency had previously made for the purposes of Standard No. 210.

The final rule did not purport to address Standard No. 210. Throughout this rulemaking, there have been no references to Standard No. 210 nor did this rule ever propose to amend Standard No. 210. Thus, NHTSA confirms Ford's understanding that nothing in this rulemaking changed or modified anything with respect to the existing requirements and interpretations of Standard No. 210.

2. *Whether Manual Belts are subject to the Labeling Requirements (i.e., are Considered Dynamically Tested) When They are Installed at Seating Positions Also Equipped With Air Bags That are Not Certified as Providing Automatic Crash Protection.*

In the preamble to the final rule, NHTSA stated that "any manual belts installed at seating positions also equipped with either automatic safety belts or air bags are *not* what NHTSA is referring to when it uses the term 'dynamically tested manual belts' in preambles or letters of interpretation" concerning Standards No. 208 and 209, 56 FR 15297; April 16, 1991.

In its petition for reconsideration, Ford asked about the final rule's applicability to manual safety belts supplied with air bags that are not certified as providing automatic crash protection. Such air bags are sometimes referred to as "face bags." Ford explained that it plans to install this sort of driver air bag on some of its 1992 model year light trucks and vans. Since this type of air bag is not certified as complying with the automatic restraint requirements of S4.1.2.1 of Standard No. 208, Ford stated its understanding that a manual belt installed at a seating position also equipped with a "face bag" would be considered a "dynamically tested" manual belt for the purposes of Standards No. 208 and 209.

Again, NHTSA confirms that Ford's understanding is correct. The new regulatory language adopted in the final rule exempts from certain static testing requirements manual belts that are subject to crash testing by virtue of any provision of Standard No. 208 other than S4.1.2.1(c)(2). S4.1.2.1(c)(2) applies only to seating positions with air bags that are certified as providing automatic crash protection. Thus, if a vehicle is equipped with an air bag at a front outboard seating position that is not certified as providing automatic crash protection, and the vehicle is subject to the crash testing requirements in S5.1 of Standard No. 208, then the manual belt required to be installed at such seating position would be considered "dynamically tested" for the purposes of Standards No. 208 and 209.

3. *Clarification of the Scope of the Labeling Requirement for Dynamically Tested Manual Belts*

Section S4.6(b) of Standard No. 209 requires a "seat belt assembly that meets the requirements of S4.6 of Standard No. 208" to be marked or labeled with the following statement:

> This dynamically-tested seat belt assembly is for use only in (insert specific seating position(s), e.g., 'front right') in (insert specific vehicle make(s) and model(s).

The April 1991 final rule did not amend this provision in Standard No. 209. It did, however, amend S4.6 of Standard No. 208. First, it deleted the old provision in S4.6.2 of Standard No. 208 referring to dynamic testing of manual belts in passenger cars if the requirement for automatic crash protectin were rescinded. Second, it added new sections S4.6 and S4.6.3 to more clearly specify which manual belts will be considered "dynamically tested" for the purposes of Standards No. 208 and 209. In addition, the preamble stated that the final rule was making no change to the existing labeling requirements for dynamically tested manual belts. This decision meant that the pre-existing requirement to label dynamically tested manual belts installed in light trucks would remain in place and in effect, while the proposal for a new requirement to label dynamically tested manual belts installed in passenger cars was not adopted.

Ford and Volkswagen petitioned to the agency to reconsider these provisions on identical grounds. These manufacturers argued that S4.6(b) of Standard No. 209 appears to require labeling of all dynamically tested manual belt assemblies regardless of the type of vehicle in which those belts are installed. This result is directly contrary to the statement in the preamble that dynamically tested manual belts installed in passenger cars where not subject to the labeling requirements. This is because S4.6(b) of Standard No. 209 requires labeling of "a seat belt assembly that meets the requirements of S4.6 of Standard No. 208." Although S4.6.1 of Standard No. 208 provides that it applies only to dynamically tested manual belts installed in light trucks, S4.6.2. and S4.6.3 by their terms apply to all dynamically tested manual belts, irrespective of the vehicle type in which those dynamically tested belts are installed. To clarify the agency's intentions, the petitioners asked that S4.6(b) of Standard No. 209 be changed to refer to S4.6.1, instead of all of S4.6, of Standard No. 208. The agency agrees that this requested change makes the standard more precise, and amends Standard No. 209 accordingly.

4. *Inconsistency of Required Labeling for Dynamically Tested Manual Belts With Load Limiters*

In the preamble to the final rule, NHTSA stated that it did not believe that extending the labeling requirements for automatic belts with load limiters (which have been in place since 1981) to dynamically tested manual belts with load limiters would result in any undue burdens for manufacturers or consumers. *See* 56 FR 15297. Notwithstanding this stated belief, Volkswagen argued in its petition that the regulatory language in S4.5 and 4.6 of Standard No. 209 imposed inconsistent labeling requirements for dynamically tested manual safety belts equipped with load limiters.

Volkswagen correctly stated that S4.5(c) of Standard No. 209 requires all safety belts with load limiters to be labeled with the following statement: "This seat belt assembly is for use only in (insert specific seating position(s), e.g., 'front right') in (insert specific vehicle make(s) and model(s)). "However, S4.6(b) of Standard No. 209 requires a dynamically tested manual belt, including dynamically tested manual belts that incorporate a load limiter, to be labeled with following statement:

"This *dynamically-tested* seat belt assembly is for use only in (insert specific seating positions(s), e.g., 'front right') in (insert specific vehicles make(s) and model(s))." (Emphasis added) Volkswagen suggested that the regulatory language in the final rule appears to require dynamically tested manual belts with load limiters to include two different labels, one consistent with S4.5(c) and one consistent with S4.5(c) and one consistent with S4.6(b).

To avoid such repetitive and unnecessary labeling, Volkswagen asked in its petition that the label specified in S4.6(b) should be revised to be identical with the label required in S4.5(c). NHTSA agrees. Accordingly, this rule deletes the phrase "dynamically tested" from the labeling required by S4.6(b) of Standard No. 209.

5. *Effective Date*

This notice makes two minor changes to the April 16, 1991 final rule in response to the petitions for reconsideration. The changes are a clarification of the scope of the labeling requirement and a slight modification of the information that must be labeled on dynamically tested manual belts pursuant to S4.6(b) of Standard No. 209. NHTSA recognizes that manufacturers may need some leadtime to modify the labels on their dynamically tested manual belts installed in light trucks and vans. Therefore, manufacturers may comply with either the label specified in the April 16, 1991 final rule version of S4.6(b) (including the words "dynamically tested") or the label specified in this amendment to S4.6(b) (deleting the words "dynamically tested"), until September 1, 1992, the effective date for this rule. After September 1, 1992, the safety belts subject to S4.6(b) of Standard No. 209 must be labeled in accordance with the amended S4.6(b) seat forth in this notice.

In consideration of the foregoing 49 CFR part 209 is amended as follows:

In § 571.209 S4.6(b) of Standard No. 209 is revised to read as follows, effective on the and after September 1, 1992 and may be used at the manufacturer's option before that date:

S4.6 *Manual belts subject to crash protection requirements of Standard No. 208.*

* * * * *

(b) A seat belt assembly certified as complying with S4.6.1 of Standard No. 208 (49 CFR 571.208) shall be permanently and legibly marked or labeled with the following statement:

> This seat belt assembly is for use only in [insert specific seating position(s), e.g., 'front right') in (insert specific vehicles make(s) and madels(s)].

* * * * *

Issued on October 30, 1991.

Jerry Ralph Curry,
Administrator

56 F.R. 56323
November 4, 1992

MOTOR VEHICLE SAFETY STANDARD NO. 209

Seat Belt Assemblies

(Docket No. 69-23)

S1. Purpose and Scope.

This standard specifies requirements for seat belt assemblies.

S2. Application.

This standard applies to seat belt assemblies for use in passenger cars, multipurpose passenger vehicles, trucks, and buses.

S3. Definitions.

"Adjustment hardware" means any or all hardware designed for adjusting the size of a seat belt assembly to fit the user, including such hardware that may be integral with a buckle, attachment hardware, or retractor.

"Attachment hardware" means any or all hardware designed for securing the webbing of a seat belt assembly to a motor vehicle.

"Automatic-locking retractor" means a retractor incorporating adjustment hardware by means of a positive self-locking mechanism which is capable when locked of withstanding restraint forces.

"Buckle" means a quick release connector which fastens a person in a seat belt assembly.

"Emergency-locking retractor" means a retractor incorporating adjustment hardware by means of a locking mechanism that is activated by vehicle acceleration, webbing movement relative to the vehicle, or other automatic action during an emergency and is capable when locked of withstanding restraint forces.

"Hardware" means any metal or rigid plastic part of a seat belt assembly.

"Load-limiter" means a seat belt assembly component or feature that controls tension on the seat belt to modulate the forces that are imparted to occupants restrained by the belt assembly during a crash.

"Nonlocking retractor" means a retractor from which the webbing is extended to essentially its full length by a small external force, which provides no adjustment for assembly length, and which may or may not be capable of sustaining restraint forces at maximum webbing extension.

"Pelvic restraint" means a seat belt assembly or portion thereof intended to restrain movement of the pelvis.

"Retractor" means a device for storing part or all of the webbing in a seat belt assembly.

"Seat belt assembly" means any strap, webbing, or similar device designed to secure a person in a motor vehicle in order to mitigate the results of any accident, including all necessary buckles and other fasteners, and all hardware designed for installing such seat belt assembly in a motor vehicle.

"Seat back retainer" means the portion of some seat belt assemblies designed to restrict forward movement of a seat back.

"Strap" means a narrow nonwoven material used in a seat belt assembly in place of webbing.

"Type 1 seat belt assembly" is a lap belt for pelvic restraint.

"Type 2 seat belt assembly" is a combination of pelvic and upper-torso restraints.

"Type 2a shoulder belt" is an upper-torso restraint for use only in conjunction with a lap belt as a Type 2 seat belt assembly.

"Upper-torso restraint" means a portion of a seat belt assembly intended to restrain movement of the chest and shoulder regions.

"Webbing" means a narrow fabric woven with continuous filling yarns and finished selvages.

S4. Requirements.

S4.1 (a) *Single occupancy.* A seat belt assembly shall be designed for use by one, and only one, person at any one time.

(b) *Pelvic restraint.* A seat belt assembly shall provide pelvic restraint whether or not upper-torso

restraint is provided, and the pelvic restraint shall be designed to remain on the pelvis under all conditions, including collision or roll-over of the motor vehicle. Pelvic restraint of a Type 2 seat belt assembly that can be used without upper torso restraint shall comply with requirements for Type 1 seat belt assembly in S4.1 to S4.4.

(c) *Upper torso restraint.* A Type 2 seat belt assembly shall provide upper-torso restraint without shifting the pelvic restraint into the abdominal region. An upper-torso restraint shall be designed to minimize vertical forces on the shoulders and spine. Hardware for upper-torso restraint shall be so designed and located in the seat belt assembly that the possibility of injury to the occupant is minimized.

A Type 2a shoulder belt shall comply with applicable requirements for a Type 2 seat belt assembly in S4.1 to S4.4, inclusive.

(d) *Hardware.* All hardware parts which contact under normal usage a person, clothing, or webbing shall be free from burrs and sharp edges.

(e) *Release.* A Type 1 or Type 2 seat belt assembly shall be provided with a buckle or buckles readily acccessible to the occupant to permit his easy and rapid removal from the assembly. Buckle release mechanism shall be designed to minimize the possibility of accidental release. A buckle with release mechanism in the latched position shall have only one opening in which the tongue can be inserted on the end of the buckle designed to receive and latch the tongue.

(f) *Attachment hardware.* [A seat belt assembly shall include all hardware necessary for installation in a motor vehicle in accordance with Society of Automotive Engineers Recommended Practice J800c, "Motor Vehicle Seat Belt Installation," November 1973.] However, seat belt assemblies designed for installation in motor vehicles equipped with seat belt assembly anchorages that do not require anchorage nuts, plates, or washers, need not have such hardware, but shall have 7/16–20 UNF–2A or 1/2–13 UNC–2A attachment bolts or equivalent hardware. The hardware shall be designed to prevent attachment bolts and other parts from becoming disengaged from the vehicle while in service. Reinforcing plates or washers furnished for universal floor installations shall be of steel, free from burrs and sharp edges on the peripheral edges adjacent to the vehicle, at least 0.06 inch in thickness and at least 4 square inches in projected area. The distance between any edge of the plate and the edge of the bolt hole shall be at least 0.6 inch. Any corner shall be rounded to a radius of not less than 0.25 inch or cut so that no corner angle is less than 135° and no side is less than 0.25 inch in length. **(48 F.R. 30138—June 30, 1983. Effective: July 30, 1983).**

(g) *Adjustment.*

(1) A Type 1 or Type 2 seat belt assembly shall be capable of adjustment to fit occupants whose dimensions and weight range from those of a 5th-percentile adult female to those of a 95th-percentile adult male. The seat belt assembly shall have either an automatic-locking retractor, an emergency-locking retractor, or an adjusting device that is within the reach of the occupant.

(2) A Type 1 or Type 2 seat belt assembly for use in a vehicle having seats that are adjustable shall conform to the requirements of S4.1(g)(1) regardless of seat position. However, if a seat has a back that is separately adjustable, the requirements of S4.1(g)(1) need be met only with the seat back in the manufacturer's nominal design riding position.

(3) The adult occupants referred to in S4.1(g)(1) shall have the following measurements:

	5th-percentile adult female	95th-percentile adult male
Weight	102 pounds	215 pounds.
Erect sitting height	30.9 inches	38 inches.
Hip breadth (sitting)	12.8 inches	16.5 inches.
Hip circumference (sitting)	36.4 inches	47.2 inches.
Waist circumference (sitting)	23.6 inches	42.5 inches.
Chest depth	7.5 inches	10.5 inches.
Chest circumference:		
(nipple)	30.5 inches	44.5 inches.
(upper)	29.8 inches	
(lower)	26.6 inches	

(h) *Webbing.* The ends of webbing in a seat belt assembly shall be protected or treated to prevent raveling. The end of webbing in a seat belt assembly having a metal-to-metal buckle that is used by the occupant to adjust the size of the assembly shall not pull out of the adjustment hardware at maximum size adjustment. Provision shall be made for essentially unimpeded movement of webbing routed between a seat back and seat cushion and attached to a retractor located behind the seat.

(i) *Strap.* A strap used in a seat belt assembly to sustain restraint forces shall comply with the requirements for webbing in S4.2, and if the strap is made from a rigid material, it shall comply with applicable requirements in S4.2, S4.3, and S4.4.

(j) *Marking.* Each seat belt assembly shall be permanently and legibly marked or labeled with year of manufacture, model, and name or trademark of manufacturer or distributor, or of importer if manufactured outside the United States. A model shall consist of a single combination of webbing having a specific type of fiber weave and construction, and hardware having a specific design. Webbings of various colors may be included under the same model, but webbing of each color shall comply with the requirements for webbing in S4.2.

(k) *Installation instructions.* A seat belt assembly or retractor shall be accompanied by an instruction sheet providing sufficient information for installing the assembly in a motor vehicle except for a seat belt assembly installed in a motor vehicle by an automobile manufacturer. [The installation instructions shall state whether the assembly is for universal installation or for installation only in specifically stated motor vehicles, and shall include at least those items specified in SAE Recommended Practice J800c, "Motor Vehicle Seat Belt Installations," November 1973. **(48 F.R. 30138—June 30, 1983. Effective: July 30, 1983)]**

(l) *Usage and maintenance instructions.* A seat belt assembly or retractor shall be accompanied by written instructions for the proper use of the assembly, stressing particularly the importance of wearing the assembly snugly and properly located on the body, and on the maintenance of the assembly and periodic inspection of all components. The instructions shall show the proper manner of threading webbing in the hardware of seat belt assemblies in which the webbing is not permanently fastened. Instructions for a nonlocking retractor shall include a caution that the webbing must be fully extended from the retractor during use of the seat belt assembly unless the retractor is attached to the free end of webbing which is not subjected to any tension during restraint of an occupant by the assembly. Instructions for Type 2a shoulder belt shall include a warning that the shoulder belt is not to be used without a lap belt.

(m) *Workmanship.* Seat belt assemblies shall have good workmanship in accordance with good commercial practice.

S4.2 Requirements for webbing.

(a) *Width.* The width of the webbing in a seat belt assembly shall be not less than 1.8 inches, except for portions that do not touch a 95th-percentile adult male with the seat in any adjustment position and the seat back in the manufacturer's nominal design riding position when measured under the conditions prescribed in S5.1(a).

(b) *Breaking strength.* The webbing in a seat belt assembly shall have not less than the following breaking strength when tested by the procedures specified in S5.1(b): Type 1 seat belt assembly—6,000 pounds or 2,720 kilograms; Type 2 seat belt assembly—5,000 pounds or 2,270 kilograms for webbing in pelvic restraint and 4,000 pounds or 1,810 kilograms for webbing in upper-torso restraint.

(c) *Elongation.* Except as provided in S4.5, the webbing in a seat belt assembly shall not be extended to more than the following elongations when subjected to the specified forces in accordance with the procedure specified in S5.1(c): Type 1 seat belt assembly— 20 percent at 2,500 pounds or 1,130 kilograms; Type 2 seat belt assembly—30 percent at 2,500 pounds or 1,130 kilograms for webbing in pelvic restraint and 40 percent at 2,500 pounds or 1,130 kilograms for webbing in upper-torso restraint.

(d) *Resistance to abrasion.* The webbing of a seat belt assembly, after being subjected to abrasion as specified in S5.1(d) or S5.3(c), shall have a breaking strength of not less than 75 percent of the breaking strength listed in S4.2(b) for that type of belt assembly.

(e) *Resistance to light.* The webbing in a seat belt assembly after exposure to the light of a carbon arc and tested by the procedure specified in S5.1(e) shall have a breaking strength not less than 60 percent of the strength before exposure to the carbon arc and shall have a color retention not less than No. 2 on the Geometric Gray Scale published by the American Association of Textile Chemists and Colorists, Post Office Box 886, Durham, N.C.

(f) *Resistance to micro-organisms.* The webbing in a seat belt assembly after being subjected to micro-organisms and tested by the procedures specified in S5.1(f) shall have a breaking strength not less than 85 percent of the strength before subjection to micro-organisms.

(g) *Colorfastness to crocking.* The webbing in a seat belt assembly shall not transfer color to a

crock cloth either wet or dry to a greater degree than class 3 on the AATCC Chart for Measuring Transference of Color published by the American Association of Textile Chemists and Colorists, when tested by the procedure specified in S5.1(g).

(h) *Colorfastness to staining.* The webbing in a seat belt assembly shall not stain to a greater degree than class 3 on the AATCC Chart for Measuring Transference of Color published by the American Association of Textile Chemists and Colorists, when tested by the procedure specified in S5.1(h).

S4.3 Requirements for hardware.

(a) *Corrosion resistance.*

(1) Attachment hardware of a seat belt assembly after being subjected to the conditions specified in S5.2(a) shall be free of ferrous corrosion on significant surfaces except for permissible ferrous corrosion at peripheral edges or edges of holes on underfloor reinforcing plates and washers. [Alternatively, such hardware at or near the floor shall be protected against corrosion by at least an electrodeposited coating of nickel, or copper and nickel with at least a service condition number of SC2, and other attachment hardware shall be protected by an electrodeposited coating of nickel, or copper and nickel with a service condition number of SC1, in accordance with American Society for Testing and Materials B456-79, "Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium," but such hardware shall not be racked for electroplating in locations subjected to maximum stress. **(48 F.R. 30138—June 30, 1983. Effective: July 30, 1983)]**

(2) Surfaces of buckles, retractors and metallic parts, other than attachment hardware, of a seat belt assembly after subjection to the conditions specified in S5.2(a) shall be free of ferrous or nonferrous corrosion which may be transferred, either directly or by means of the webbing, to the occupant or his clothing when the assembly is worn. After test, buckles shall conform to applicable requirements in paragraphs (d) to (g) of this section.

(b) *Temperature resistance.* Plastic or other nonmetallic hardware parts of a seat belt assembly when subjected to the conditions specified in S5.2(b) shall not warp or otherwise deteriorate to cause the assembly to operate improperly or fail to comply with applicable requirements in this section and S4.4.

(c) *Attachment hardware.*

(1) Eye bolts, shoulder bolts, or other bolts used to secure the pelvic restraint of a seat belt assembly to a motor vehicle shall withstand a force of 9,000 pounds or 4,080 kilograms when tested by the procedure specified in S5.2(c)(1), except that attachment bolts of a seat belt assembly designed for installation in specific models of motor vehicles in which the ends of two or more seat belt assemblies can not be attached to the vehicle by a single bolt shall have a breaking strength of not less than 5,000 pounds or 2,270 kilograms.

(2) Other attachment hardware designed to receive the ends of two seat belt assemblies shall withstand a tensile force of at least 6,000 pounds or 2,720 kilograms without fracture of any section when tested by the procedure specified in S5.2(c)(2).

(3) A seat belt assembly having single attachment hooks of the quick-disconnect type for connecting webbing to an eye bolt shall be provided with a retaining latch or keeper which shall not move more than 0.08 inch or 2 millimeters in either the vertical or horizontal direction when tested by the procedure specified in S5.2(c)(3).

(d) *Buckle release.*

(1) The buckle of a Type 1 or Type 2 seat belt assembly shall release when a force of not more than 30 pounds or 14 kilograms is applied.

(2) A buckle designed for pushbutton application of buckle release force shall have a minimum area of 0.7 square inch or 4.5 square centimeters with a minimum linear dimension of 0.4 inch or 10 millimeters for applying the release force, or a buckle designed for lever application of a buckle release force shall permit the insertion of a cylinder 0.4 inch or 10 millimeters in diameter and 1.5 inches or 38 millimeters in length to at least the midpoint of the cylinder along the cylinder's entire length in the actuation portion of the buckle release. A buckle having other design for release shall have adequate access for two or more fingers to actuate release.

(3) The buckle of a Type 1 or Type 2 seat belt assembly shall not release under a compressive force of 400 pounds applied as prescribed in paragraph S5.2(d)(3). The buckle shall be operable and shall meet the applicable requirements of paragraph S4.4 after the compressive force has been removed.

(e) *Adjustment force.* The force required to decrease the size of a seat belt assembly shall not exceed 11 pounds or 5 kilograms when measured by the procedure specified in S5.2(e).

(f) *Tilt-lock adjustment.* The buckle of a seat belt assembly having tilt-lock adjustment shall lock the webbing when tested by the procedure specified in S5.2(f) at an angle of not less than 30 degrees between the base of the buckle and the anchor webbing.

(g) *Buckle latch.* The buckle latch of a seat belt assembly when tested by the procedure specified in S5.2(g) shall not fail, nor gall or wear to an extent that normal latching and unlatching is impaired, and a metal-to-metal buckle shall separate when in any position of partial engagement by a force of not more than 5 pounds or 2.3 kilograms.

(h) *Nonlocking retractor.* The webbing of a seat belt assembly shall extend from a nonlocking retractor within 0.25 inch or 6 millimeters of maximum length when a tension is applied as prescribed in S5.2(h). A nonlocking retractor on upper-torso restraint shall be attached to the nonadjustable end of the assembly, the reel of the retractor shall be easily visible to an occupant while wearing the assembly, and the maximum retraction force shall not exceed 1.1 pounds or 0.5 kilogram in any strap or webbing that contacts the shoulder when measured by the procedure specified in S5.2(h), unless the retractor is attached to the free end of webbing which is not subjected to any tension during restraint of an occupant by the assembly.

(i) *Automatic-locking retractor.* The webbing of a seat belt assembly equipped with an automatic-locking retractor, when tested by the procedure specified in S5.2(i), shall not move more than 1 inch or 25 millimeters between locking positions of the retractor, and shall be retracted with a force under zero acceleration of not less than 0.6 pound or 0.27 kilogram when attached to pelvic restraint, and not less than 0.45 pound or 0.2 kilogram nor more than 1.1 pounds or 0.5 kilogram in any strap or webbing that contacts the shoulder of an occupant when the retractor is attached to upper-torso restraint. An automatic-locking retractor attached to upper-torso restraint shall not increase the restraint on the occupant of the seat belt assembly during use in a vehicle traveling over rough roads as prescribed in S5.2(i).

(j) *Emergency-locking retractor.* An emergency-locking retractor of a Type 1 or Type 2 seat belt assembly, when tested in accordance with the procedures specified in paragraph S5.2(j)—

(1) Shall lock before the webbing extends 1 inch when the retractor is subjected to an acceleration of 0.7g;

(2) Shall not lock, if the retractor is sensitive to webbing withdrawal, before the webbing extends 2 inches when the retractor is subjected to an acceleration of 0.3g or less;

(3) Shall not lock, if the retractor is sensitive to vehicle acceleration, when the retractor is rotated in any direction to any angle of 15° or less from its orientation in the vehicle;

(4) Shall exert a retractive force of at least 0.6 pound under zero acceleration when attached only to the pelvic restraint;

(5) Shall exert a retractive force of not less than 0.2 pound and not more than 1.1 pounds under zero acceleration when attached only to an upper-torso restraint;

(6) Shall exert a retractive force of not less than 0.2 pound and not more than 1.5 pounds under zero acceleration when attached to a strap or webbing that restrains both the upper torso and the pelvis.

(k) *Performance of retractor.* A retractor used on a seat belt assembly after subjection to the tests specified in S5.2(k) shall comply with applicable requirements in paragraphs (h) to (j) of this section and S4.4, except that the retraction force shall be not less than 50 percent of its original retraction force.

S4.4 Requirements for assembly performance.

(a) *Type 1 seat belt assembly.* Except as provided in S4.5, the complete seat belt assembly including webbing, straps, buckles, adjustment and attachment hardware, and retractors shall comply with the following requirements when tested by the procedures specified in S5.3(a):

(1) The assembly loop shall withstand a force of not less than 5,000 pounds or 2,270 kilograms; that is, each structural component of the assembly shall withstand a force of not less than 2,500 pounds or 1,130 kilograms.

(2) The assembly loop shall extend not more than 7 inches or 18 centimeters when subjected to a force of 5,000 pounds or 2,270 kilograms; that is, the length of the assembly between anchorages shall not increase more than 14 inches or 36 centimeters.

(3) Any webbing cut by the hardware during test shall have a breaking strength at the cut of not less than 4,200 pounds or 1,910 kilograms.

(4) Complete fracture through any solid section of metal attachment hardware shall not occur during test.

(b) *Type 2 seat belt assembly.* Except as provided in S4.5, the components of a Type 2 seat belt assembly including webbing, straps, buckles, adjustment and attachment hardware, and retractors shall comply with the following requirements when tested by the procedure specified in S5.3(b):

(1) The structural components in the pelvic restraint shall withstand a force of not less than 2,500 pounds or 1,139 kilograms.

(2) The structural components in the upper-torso restraint shall withstand a force of not less than 1,500 pounds or 680 kilograms.

(3) The structural components in the assembly that are common to pelvic and upper-torso restraints shall withstand a force of not less than 3,000 pounds or 1,360 kilograms.

(4) The length of the pelvic restraint between anchorages shall not increase more than 20 inches or 50 centimeters when subjected to a force of 2,500 pounds or 1,130 kilograms.

(5) The length of the upper-torso restraint between anchorages shall not increase more than 20 inches or 50 centimeters when subjected to a force of 1,500 pounds or 680 kilograms.

(6) Any webbing cut by the hardware during test shall have a breaking strength of not less than 3,500 pounds or 1,590 kilograms at a cut in webbing of the pelvic restraint, or not less than 2,800 pounds or 1,270 kilograms at a cut in webbing of the upper-torso restraint.

(7) Complete fracture through any solid section of metal attachment hardware shall not occur during test.

S4.5 Load-limiter.

(a) A Type 1 or Type 2 seat belt assembly that includes a load-limiter is not required to comply with the elongation requirements of S4.2(c), S4.4(a)(2), S4.4(b)(4) or S4.4(b)(5).

(b) A seat belt assembly that includes a load limiter and that does not comply with the elongation requirements of this standard may be installed in motor vehicles at any designated seating position that is subject to the requirements of S5.1 of Standard No. 208 (§ 571.208).

(c) A seat belt assembly that includes a load limiter and that does not comply with the elongation requirements of this standard shall be permanently and legibly marked or labeled with the following statement:

This seat belt assembly is for use only in [insert specific seating position(s), e.g., "front right"] in [insert specific vehicles make(s) and model(s)]

S4.6 Manual belts subject to crash protection requirements of Standard No. 208.

(a)(1) A manual seat belt assembly, which is subject to the requirements of S5.1 of Standard No. 208 (49 CFR § 571.208) by virtue of any provision of Standard No. 208 other than S4.1.2.1(c)(2) of that standard, does not have to meet the requirements of S4.2(a)-(f) and S4.4 of this standard.

(2) A manual seat belt assemble subject to the requirements of S5.1 of Standard No. 208 (49 CFR § 571.208) by virtue of S4.1.2.1(c)(2) of Standard No. 208 does not have to meet the elongation requirements of S4.2(c), S4.4(a)(2), S4.4(b)(4), and S4.4(b)(5) of this standard.

(b) [A seat belt assembly certified as complying with S4.6.1 of Standard No. 208 (49 CFR 571.208) shall be permanently and legibly marked or labeled with the following statement:

This seat belt assembly is for use only in (insert specific seating position(s), e.g., "front right") in (insert specific vehicle make(s), and model(s))."

(56 F.R. 56323—November 4, 1992.)

Effective: September 1, 1992. Safety belts and vehicles manufactured before September 1, 1992 may comply with the post September 1, 1992 requirements for belt labeling.)]

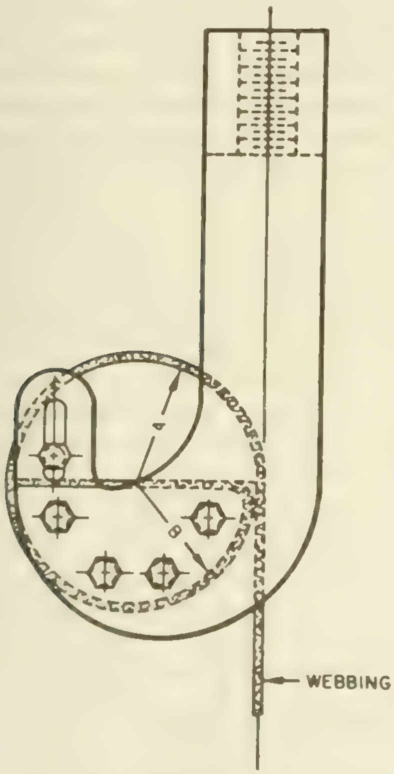
S5. Demonstration procedures.

S5.1 Webbing.

(a) *Width.* The width of webbing from three seat belt assemblies shall be measured after conditioning for at least 24 hours in an atmosphere having relative humidity between 48 and 67 percent and a temperature of $23° \pm 2°$ C or $73.4° \pm 3.6°$ F. The tension during measurement of width shall be not more than 5 pounds or 2 kilograms on webbing from a Type 1 seat belt assembly, and $2{,}200 \pm 100$ pounds or $1{,}000 \pm 50$ kilograms on webbing from a Type 2 seat belt assembly. The width of webbing from a Type 2 seat belt assembly may be measured during the

breaking strength test described in paragraph (b) of this section.

(b) *Breaking strength.* Webbing from three seat belt assemblies shall be conditioned in accordance with paragraph (a) of this section and tested for breaking strength in a testing machine of capacity verified to have an error of not more than one percent in the range of the breaking strength of the webbing in accordance with American Society for Testing and Materials E4–79, "Standard Methods of Load Verification of Testing Machines."



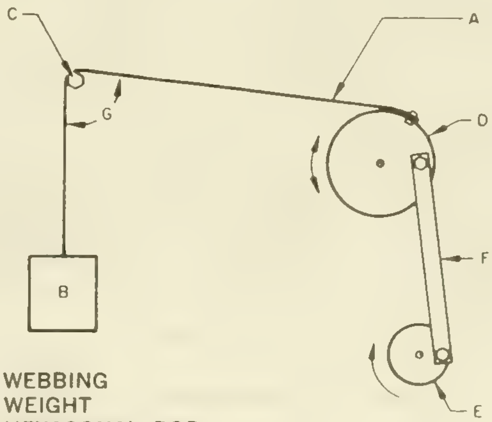
A 1 TO 2 INCHES OR 2.5 TO 5 CENTIMETERS
B A MINUS 0.06 INCH 0.15 CENTIMETER

FIGURE 1

The machine shall be equipped with split drum grips illustrated in Figure 1, having a diameter between 2 and 4 inches or 5 and 10 centimeters. The rate of grip separation shall be between 2 and 4 inches per minute or 5 and 10 centimeters per minute. The distance between the centers of the grips at the start of the test shall be between 4 and 10 inches or 10 and 25 centimeters. After placing the specimen in the grips, the webbing shall be stretched continuously at a uniform rate to failure. Each value shall be not less than the applicable breaking strength requirement in S4.2(b), but the median value shall be used for determining the retention of breaking strength in paragraphs (d), (e), and (f) of this section.

(c) *Elongation.* Elongation shall be measured during the breaking strength test described in paragraph (b) of this section by the following procedure: A preload between 44 and 55 pounds or 20 and 25 kilograms shall be placed on the webbing mounted in the grips of the testing machine and the needle points of an extensometer, in which the points remain parallel during test, are inserted in the center of the specimen. Initially the points shall be set at a known distance apart between 4 and 8 inches or 10 and 20 centimeters. When the force on the webbing reaches the value specified in S4.2(c), the increase in separation of the points of the extensometer shall be measured and the percent elongation shall be calculated to the nearest 0.5 percent. Each value shall be not more than the appropriate elongation requirement in S4.2(c).

(d) *Resistance to abrasion.* The webbing from three seat belt assemblies shall be tested for resistance to abrasion by rubbing over the hexagon bar prescribed in Figure 2 in the following manner:



A — WEBBING
B — WEIGHT
C — HEXAGONAL ROD
STEEL — SAE 51416
ROCKWELL HARDNESS — B-97 TO B-101
SURFACE — COLD DRAWN FINISH
SIZE — 0.250 ± 0.001 INCH OR 6.35 ± 0.03 MILLIMETER
RADIUS ON EDGES — 0.020 ± 0.004 INCH OR 0.5 ± 0.1 MILLIMETER
D — DRUM DIAMETER — 16 INCHES OR 40 CENTIMETERS
E — CRANK
F — CRANK ARM
G — ANGLE BETWEEN WEBBING — 85 ± 2 DEGS.

FIGURE 2

The webbing shall be mounted in the apparatus shown schematically in Figure 2. One end of the webbing (A) shall be attached to a weight (B) which has a mass of 5.2±0.1 pounds or 2.35±0.05 kilograms, except that a mass of 3.3±0.1 pounds or 1.50±0.05 kilograms shall be used for webbing in pelvic and upper-torso restraints of a belt assembly used in a child restraint system. The webbing shall be passed over the two new abrading edges of the hexagon bar (C) and the other end attached to an oscillating drum (D) which has a stroke of 13 inches or 33 centimeters. Suitable guides shall be used to prevent movement of the webbing along the axis of hexagonal bar C. Drum D shall be oscillated for 5,000 strokes or 2,500 cycles at a rate of 60±2 strokes per minute or 30±1 cycles per minute. The abraded webbing shall be conditioned as prescribed in paragraph (a) of this section and tested for breaking strength by the procedure described in paragraph (b) of this section. The median values for the breaking strengths determined on abraded and unabraded specimens shall be used to calculate the percentage of braking strength retained.

(e) *Resistance to light.* [Webbing at least 20 inches or 50 centimeters in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM Designation: G23–81, published by the American Society for Testing and Materials, except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wave lengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanometers. The apparatus shall be operated without water spray at an air temperature of 60°±2 degrees Celsius or 140°±3.6 degrees Fahrenheit measured at a point 1.0±0.2 inch or 25±5 millimeters outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimens shall be exposed to light from the carbon arc for 100 hours and then conditioned as prescribed in paragraph (a) of this section. The colorfastness of the exposed and conditioned specimens shall be determined on the Geometric Gray Scale issued by the American Association of Textile Chemists and Colorists. The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph (b) of this section. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained. **(49 F.R. 36507—September 18, 1984. Effective: September 18, 1985)]**

(f) *Resistance to micro-organisms.* Webbing at least 20 inches or 50 centimeters in length from three seat belt assemblies shall first be preconditioned in accordance with Appendix A(1) and (2) of American Association of Textile Chemists and Colorists Test Method 30–81, "Fungicides Evaluation on Textiles; Mildew and Rot Resistance of Textiles," and then subjected to Test I, "Soil Burial Test" of that test method. After soil-burial for a period of 2 weeks, the specimen shall be washed in water, dried and conditioned as prescribed in paragraph (a) of this section. The breaking strengths of the specimens shall be determined by the procedure prescribed in paragraph (b) of this section. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained.

> NOTE.—This test shall not be required on webbing made from material which is inherently resistant to micro-organisms.

(g) *Colorfastness to crocking.* Webbing from three seat belt assemblies shall be tested by the procedure specified in American Association of Textile Chemists and Colorists Standard Test Method 8–181, "Colorfastness to Crocking: AATCC Crockmeter Method."

(h) *Colorfastness to staining.* Webbing from three seat belt assemblies shall be tested by the procedure specified in American Association of Textile Chemists and Colorists (AATCC) Standard Test Method 107–1981, "Colorfastness to Water," except that the testing shall use (1) distilled water, (2) the AATCC perspiration tester, (3) a drying time of four hours, specified in section 7.4 of the AATCC procedure, and (4) section 9 of the AATCC test procedures to determine the colorfastness to staining on the AATCC Chromatic Transference Scale.

S5.2 Hardware.

(a) *Corrosion resistance.* Three seat belt assemblies shall be tested in accordance with American Society for Testing and Materials

B117–73, "Standard Method of Salt Spray (Fog) Testing." Any surface coating or material not intended for permanent retention on the metal parts during service life shall be removed prior to preparation of the test specimens for testing. The period of test shall be 50 hours for all attachment hardware at or near the floor, consisting of two periods of 24 hours exposure to salt spray followed by 1 hour drying and 25 hours for all other hardware, consisting of one period of 24 hours exposure to salt spray followed by 1 hour drying. In the salt spray test chamber, the parts from the three assemblies shall be oriented differently, selecting those orientations most likely to develop corrosion on the larger areas. At the end of test, the seat belt assembly shall be washed thoroughly with water to remove the salt. After drying for at least 24 hours under standard laboratory conditions specified in S5.1(a) attachment hardware shall be examined for ferrous corrosion on significant surfaces, that is, all surfaces that can be contacted by a sphere 0.75 inch or 2 centimeters in diameter, and other hardware shall be examined for ferrous and nonferrous corrosion which may be transferred, either directly or by means of the webbing, to a person or his clothing during use of a seat belt assembly incorporating the hardware.

NOTE.—When attachment and other hardware are permanently fastened, by sewing or other means, to the same piece of webbing, separate assemblies shall be used to test the two types of hardware. The test for corrosion resistance shall not be required for attachment hardware made from corrosion-resistant steel containing at least 11.5 percent chromium or for attachment hardware protected with an electrodeposited coating of nickel, or copper and nickel, as prescribed in S4.3(a). The assembly that has been used to test the corrosion resistance of the buckle shall be used to measure adjustment force, tilt-lock adjustment, and buckle latch in paragraphs (e), (f) and (g), respectively, of this section, assembly performance in S5.3 and buckle release force in paragraph (d) of this section.

(b) *Temperature resistance.* Three seat belt assemblies having plastic or nonmetallic hardware or having retractors shall be subjected to the conditions prescribed in Procedure D of American Society for Testing and Materials D756–78, "Standard Practice for Determination of Weight and Shape Changes of Plastics under Accelerated Service Conditions." The dimension and weight measurement shall be omitted. Buckles shall be unlatched and retractors shall be fully retracted during conditioning. The hardware parts after conditioning shall be used for all applicable tests in S4.3 and S4.4.

(c) *Attachment hardware.*

(1) Attachment bolts used to secure the pelvic restraint of a seat belt assembly to a motor vehicle shall be tested in a manner similar to that shown in Figure 3. The load shall be applied at an angle of 45 degrees to the axis of the bolt through attachment hardware from the seat belt assembly, or through a special fixture which simulates the loading applied by the attachment hardware. The attachment hardware or simulated fixture shall be fastened by the bolt to the anchor-

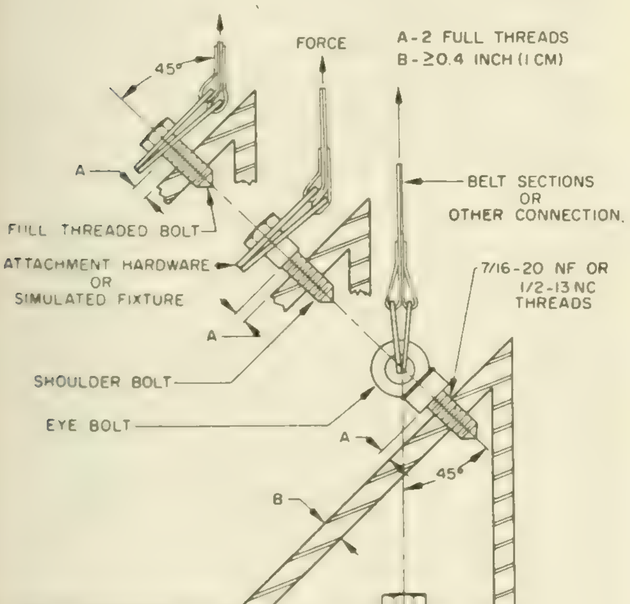


FIGURE 3

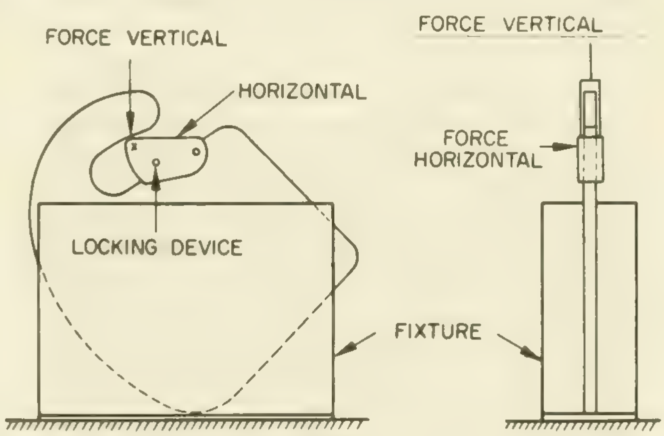


FIGURE 4
SINGLE ATTACHMENT HOOK

age shown in Figure 3, which has a standard 7/16–20 UNF–2B or 1/2–13 UNC–2B threaded hole in a hardened steel plate at least 0.4 inch or 1 centimeter in thickness. The bolt shall be installed with two full threads exposed from the fully seated position. The appropriate force required by S4.3(c) shall be applied. A bolt from each of three seat belt assemblies shall be tested.

(2) Attachment hardware, other than bolts, designed to receive the ends of two seat belt assemblies shall be subjected to a tensile force of 6,000 pounds or 2,720 kilograms in a manner simulating use. The hardware shall be examined for fracture after the force is released. Attachment hardware from three seat belt assemblies shall be tested.

(3) Single attachment hook for connecting webbing to any eye bolt shall be tested in the following manner: The hook shall be held rigidly so that the retainer latch or keeper, with cotter pin or other locking device in place, is in a horizontal position as shown in Figure 4. A force of 150 ± 2 pounds or 68 ± 1 kilograms shall be applied vertically as near as possible to the free end of the retainer latch, and the movement of the latch by this force at the point of application shall be measured. The vertical force shall be released, and a force of 150 ± 2 pounds or 68 ± 1 kilograms shall be applied horizontally as near as possible to the free end of the retainer latch. The movement of the latch by this force at the point of load application shall be measured. Alternatively, the hook may be held in other positions, provided the forces are applied and the movements of the latch are measured at the points indicated in Figure 4. A single attachment hook from each of three seat belt assemblies shall be tested.

(d) *Buckle release.*

(1) Three seat belt assemblies shall be tested to determine compliance with the maximum buckle release force requirements, following the assembly test in S5.3. After subjection to the force applicable for the assembly being tested, the force shall be reduced and maintained at 150 pounds on the assembly loop of a Type 1 seat belt assembly, 75 pounds on the components of a Type 2 seat belt assembly. The buckle release force shall be measured by applying a force on the buckle in a manner and direction typical of those which would be employed by a seat belt occupant. For pushbutton-release buckles, the force shall be applied at least 0.125 inch from the edge of the push-button access opening of the buckle in a direction that produces maximum releasing effect. For lever-release buckles, the force shall be applied on the centerline of the buckle level or finger tab in a direction that produces maximum releasing effect.

(2) The area for application of release force on pushbutton actuated buckle shall be measured to the nearest 0.05 square inch or 0.3 square centimeter. The cylinder specified in S4.3(d) shall be inserted in the actuation portion of a lever release buckle for determination of compliance with the requirement. A buckle with other release actuation shall be examined for access of release by fingers.

(3) The buckle of a Type 1 or Type 2 seat belt assembly shall be subjected to a compressive force of 400 pounds applied anywhere on a test line that is coincident with the centerline of the belt extended through the buckle or on any line that extends over the center of the release mechanism and intersects the extended centerline of the belt at an angle of 60°. The load shall be applied by using a curved cylindrical bar having a cross section diameter of 0.75 inch and a radius of curvature of 6 inches, placed with its longitudinal centerline along the test line and its center directly above the point on the buckle to which the load will be applied. The buckle shall be latched, and a tensile force of 75 pounds shall be applied to the connected webbing during the application of the compressive force. Buckles from three seat belt assemblies shall be tested to determine compliance with paragraph S4.3(d) (3).

(e) *Adjustment force.* Three seat belt assemblies shall be tested for adjustment force on the webbing at the buckle, or other manual adjusting device normally used to adjust the size of the assembly. With no load on the anchor end, the webbing shall be drawn through the adjusting device at a rate of 20 ± 2 inches per minute or 50 ± 5 centimeters per minute and the maximum force shall be measured to the nearest 0.25 pound or 0.1 kilogram after the first 1.0 inch or 25 millimeters of webbing movement. The webbing shall be precycled 10 times prior to measurement.

(f) *Tilt-lock adjustment.* This test shall be made on buckles or other manual adjusting devices having tilt-lock adjustment normally used to adjust the size of the assembly. Three buckles or devices shall be tested. The base of the adjustment mechanism

and the anchor end of the webbing shall be oriented in planes normal to each other. The webbing shall be drawn through the adjustment mechanism in a direction to increase belt length at a rate of 20 ± 2 inches per minute or 50 ± 5 centimeters per minute while the plane of the base is slowly rotated in a direction to lock the webbing. Rotation shall be stopped when the webbing locks, but the pull on the webbing shall be continued until there is a resistance of at least 20 pounds or 9 kilograms. The locking angle between the anchor end of the webbing and the base of the adjustment mechanism shall be measured to the nearest degree. The webbing shall be precycled 10 times prior to measurement.

(g) *Buckle latch.* The buckles from three seat belt assemblies shall be opened fully and closed at least 10 times. [Then the buckles shall be clamped or firmly held against a flat surface so as to permit normal movement of buckle parts, but with the metal mating plate (metal-to-metal buckles) or webbing end (metal-to-webbing buckles) withdrawn from the buckle.] The release mechanism shall be moved 200 times through the maximum possible travel against its stop with a force of 30 ± 3 pounds or 14 ± 1 kilograms at a rate not to exceed 30 cycles per minute. The buckle shall be examined to determine compliance with the performance requirements of S4.3(g). A metal-to-metal buckle shall be examined to determine whether partial engagement is possible by means of any technique representative of actual use. If partial engagement is possible, the maximum force of separation when in such partial engagement shall be determined.

(h) *Nonlocking retractor.* After the retractor is cycled 10 times by full extension and retraction of the webbing, the retractor and webbing shall be suspended vertically and a force of 4 pounds or 1.8 kilograms shall be applied to extend the webbing from the retractor. The force shall be reduced to 3 pounds or 1.4 kilograms when attached to a pelvic restraint, or to 1.1 pounds or 0.5 kilogram per strap or webbing that contacts the shoulder of an occupant when retractor is attached to an upper-torso restraint. The residual extension of the webbing shall be measured by manual rotation of the retractor drum or by disengaging the retraction mechanism. Measurements shall be made on three retractors. The location of the retractor attached to upper-torso restraint shall be examined for visibility of reel during use of seat belt assembly in a vehicle.

NOTE.—This test shall not be required on a nonlocking retractor attached to the free-end of webbing which is not subjected to any tension during restraint of an occupant by the assembly. **(45 F.R. 29045—May 1, 1980. Effective: 5/1/80)**

(i) *Automatic-locking retractor.* Three retractors shall be tested in a manner to permit the retraction force to be determined exclusive of the gravitational forces on hardware or webbing being retracted. The webbing shall be fully extended from the retractor. While the webbing is being retracted, the average force of retraction within plus or minus 2 inches or 5 centimeters of 75 percent extension (25-percent retraction) shall be determined and the webbing movement between adjacent locking segments shall be measured in the same region of extension. A seat belt assembly with automatic locking retractor in upper torso restraint shall be tested in a vehicle in a manner prescribed by the installation and usage instructions. The retraction force on the occupant of the seat belt assembly shall be determined before and after traveling for 10 minutes at a speed of 15 miles per hour or 24 kilometers per hour or more over a rough road (e.g., Belgian block road) where the occupant is subjected to displacement with respect to the vehicle in both horizontal and vertical directions. Measurements shall be made with the vehicle stopped and the occupant in the normal seated position.

(j) *Emergency-locking retractor.* A retractor shall be tested in a manner that permits the retraction force to be determined exclusive of the gravitational forces on hardware or webbing being retracted. The webbing shall be fully extended from the retractor, passing over or through any hardware or other material specified in the installation instructions. While the webbing is being retracted, the lowest force of retraction within plus or minus 2 inches of 75 percent extension shall be determined. A retractor that is sensitive to webbing withdrawal shall be subjected to an acceleration of 0.3g within a period of 50 milliseconds while the webbing is at 75-percent extension, to determine compliance with S4.3(j) (2). The retractor shall be subjected to an acceleration of 0.7g within a period of 50 milliseconds, while the webbing is at 75-percent extension, and the webbing movement before locking shall be measured under the following conditions: For a retractor sensitive to webbing withdrawal, the retractor shall be accelerated in the direction of webbing retraction while the retractor drum's central axis is oriented horizontally and at angles of 45°, 90°, 135°, and 180° to the horizontal plane. For a retractor sensitive to vehicle acceleration, the retractor shall be—

(1) accelerated in the horizontal plane in two directions normal to each other, while the retractor drum's central axis is oriented at the angle at which it is installed in the vehicle; and,

(2) accelerated in three directions normal to each other while the retractor drum's central axis is oriented at angles of 45°, 90°, 135° and 180° from the angle at which it is installed in the vehicle, unless the retractor locks by gravitational force when tilted in any direction to any angle greater than 45° from the angle at which it is installed in the vehicle.

(k) *Performance of retractor.* After completion of the corrosion-resistance test described in paragraph (a) of this section, the webbing shall be fully extended and allowed to dry for at least 24 hours under standard laboratory conditions specified in S5.1(a). [Then, the retractor and webbing shall be subjected to dust in a chamber similar to one illustrated in Figure 8 containing about 2 pounds or 0.9 kilogram of coarse grade dust conforming to the specification given in Society of Automotive Engineering Recommended Practice J726, "Air Cleaner Test Code" Sept. 1979.] The webbing shall be withdrawn manually and allowed to retract for 25 cycles. The retractor shall be mounted in an apparatus capable of extending the webbing fully, applying a force of 20 pounds or 9 kilograms at full extension, and allowing the webbing to retract freely and completely. The webbing shall be withdrawn from the retractor and allowed to retract repeatedly in this apparatus until 2,500 cycles are completed. The retractor and webbing shall then be subjected to the temperature resistance test prescribed in paragraph (b) of this section. The retractor shall be subjected to 2,500 additional cycles of webbing withdrawal and retraction. Then, the retractor and webbing shall be subjected to dust in a chamber similar to one illustrated in Figure 6 containing about 2 pounds or 0.9 kilogram of coarse grade dust conforming to the specification given in SAE Recommended Practice, Air Cleaner Test Code—SAE J726a, published by the Society of Automotive Engineers. The dust shall be agitated every 20 minutes for 5 seconds by compressed air, free of oil and moisture, at a gage pressure of 80 ± 8 pounds per square inch or 5.6 ± 0.6 kilograms per square centimeter entering through an orifice 0.060 ± 0.004 inch or 1.5 ± 0.1 millimeters in diameter. The webbing shall be extended to the top of the chamber and kept extended at all times except that the webbing shall be subjected to 10 cycles of complete retraction and extension within 1 to 2 minutes after each agitation of the dust. At the end of 5 hours, the assembly shall be removed from the chamber. The webbing shall be fully withdrawn from the retractor manually and allowed to retract completely for 25 cycles. An automatic-locking retractor or a nonlocking retractor attached to pelvic restraint shall be subjected to 5,000 additional cycles of webbing withdrawal and retraction. An emergency-locking retractor or a nonlocking retractor attached to upper-torso restraint shall be subjected to 45,000 additional cycles of webbing withdrawal and retraction between 50 and 100 percent extension. The locking mechanism of an emergency-locking retractor shall be actuated at least 10,000 times

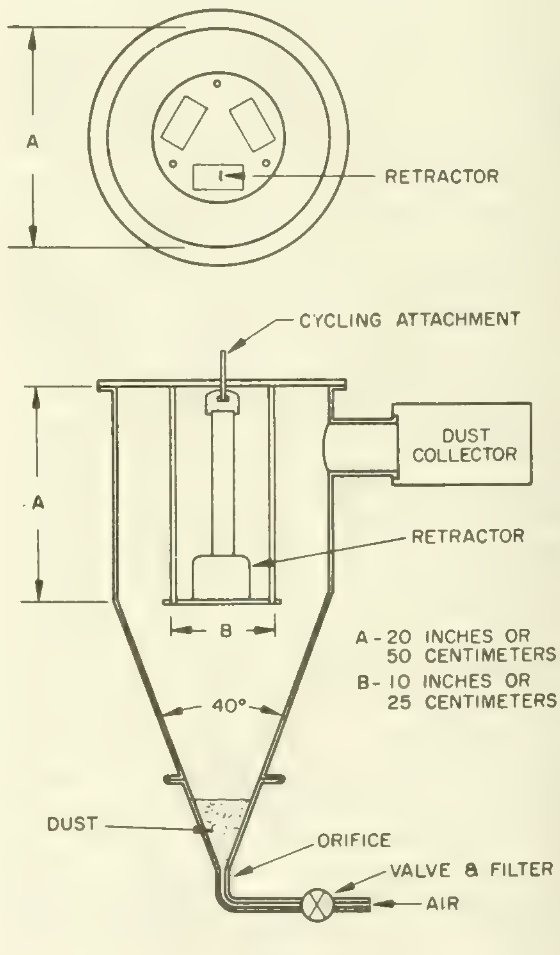


FIGURE 6

within 50 to 100 percent extension of webbing during the 50,000 cycles. At the end of test, compliance of the retractors with applicable requirements in S4.3(h), (i), and (j) shall be determined. Three retractors shall be tested for performance. **(48 F.R. 30138—June 30, 1983. Effective: July 30, 1983)**

S5.3 Assembly performance.

(a) *Type 1 seat belt assembly.* Three complete seat belt assemblies, including webbing, straps, buckles, adjustment and attachment hardware, and retractors, arranged in the form of a loop as shown in Figure 5, shall be tested in the following manner:

(1) The testing machine shall conform to the requirements specified in S5.1(b). A double-roller block shall be attached to one head of the testing machine. This block shall consist of 2 rollers 4 inches or 10 centimeters in diameter and sufficiently long so that no part of the seat belt assembly touches parts of the block other than the rollers during test. The rollers shall be mounted on anti-friction bearings and spaced 12 inches or 30 centimeters between centers, and shall have sufficient capacity so that there is no brinelling, bending or other distortion of parts which may affect the results. An anchorage bar shall be fastened to the other head of the testing machine.

(2) The attachment hardware furnished with the seat belt assembly shall be attached to the anchorage bar. The anchor points shall be spaced so that the webbing is parallel in the two sides of the loop. The attaching bolts shall be parallel to, or at an angle of 45 or 90 degrees to the webbing, whichever results in an angle nearest to 90 degrees between webbing and attachment hardware except that eye bolts shall be vertical, and attaching bolts or nonthreaded anchorages of a seat belt assembly designed for use in specific models of motor vehicles shall be installed to produce the maximum angle in use indicated by the installation instructions, utilizing special fixtures if necessary to simulate installation in the motor vehicle. Rigid adapters between anchorage bar and attachment hardware shall be used if necessary to locate and orient the adjustment hardware. The adapters shall have a flat support face perpendicular to the threaded hole for the attaching bolt and adequate in area to provide full support for the base of the attachment hardware connected to the webbing. If necessary, a washer shall be used under a swivel plate or other attachment hardware to prevent the webbing from being damaged as the attaching bolt is tightened.

(3) The length of the assembly loop from attaching bolt to attaching bolt shall be adjusted to about 51 inches or 130 centimeters, or as near thereto as possible. A force of 55 pounds or 25 kilograms shall be applied to the loop to remove any slack in webbing at hardware. The force shall be removed and the heads of the testing machine shall be adjusted for an assembly loop between 48 and 50 inches or 122 and 127 centimeters in length. The length of the assembly loop shall then be adjusted by applying a force between 20 and 22 pounds or 9 and 10 kilograms to the free end of the webbing at the buckle, or by the retraction force of an automatic-locking or emergency-locking retractor. A seat belt assem-

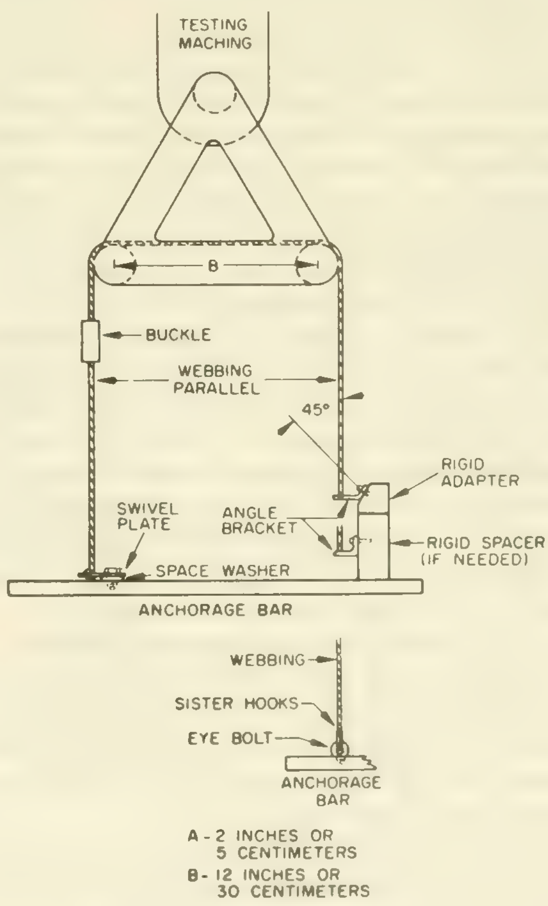


FIGURE 5

bly that cannot be adjusted to this length shall be adjusted as closely as possible. An automatic-locking or emergency-locking retractor when included in a seat belt assembly shall be locked at the start of the test with a tension on the webbing slightly in excess of the retractive force in order to keep the retractor locked. The buckle shall be in a location so that it does not touch the rollers during test, but to facilitate making the buckle release test in S5.2(d) the buckle should be between the rollers or near a roller in one leg.

(4) The heads of the testing machine shall be separated at a rate between 2 and 4 inches per minute or 5 and 10 centimeters per minute until a force of 5,000 ± 50 pounds or 2,270 ± 20 kilograms is applied to the assembly loop. The extension of the loop shall be determined from measurements of head separation before and after the force is applied. The force shall be decreased to 150 ± 10 pounds or 68 ± 4 kilograms and the buckle release force measured as prescribed in S5.2(d).

(5) After the buckle is released, the webbing shall be examined for cutting by the hardware. If the yarns are partially or completely severed in a line for a distance of 10 percent or more of the webbing width, the cut webbing shall be tested for breaking strength as specified in S5.1(b) locating the cut in the free length between grips. If there is insufficient webbing on either side of the cut to make such a test for breaking strength, another seat belt assembly shall be used with the webbing repositioned in the hardware. A tensile force of 2,500 ± 25 pounds or 1,135 ± 10 kilograms shall be applied to the components or a force of 5,000 ± 50 pounds or 2,270 ± 20 kilograms shall be applied to an assembly loop. After the force is removed, the breaking strength of the cut webbing shall be determined as prescribed above.

(6) If a Type 1 seat belt assembly includes an automatic-locking retractor or an emergency-locking retractor, the webbing and retractor shall be subjected to a tensile force of 2,500 ± 25 pounds or 1,135 ± 10 kilograms with the webbing fully extended from the retractor.

(7) If a seat belt assembly has a buckle in which the tongue is capable of inverted insertion, one of the three assemblies shall be tested with the tongue inverted.

(b) *Type 2 seat belt assembly.* Components of three seat belt assemblies shall be tested in the following manner:

(1) The pelvic restraint between anchorages shall be adjusted to a length between 48 and 50 inches or 122 and 127 centimeters, or as near this length as possible if the design of the pelvic restraint does not permit its adjustment to this length. An automatic-locking or emergency-locking retractor when included in a seat belt assembly shall be locked at the start of the test with a tension on the webbing slightly in excess of the retractive force in order to keep the retractor locked. The attachment hardware shall be oriented to the webbing as specified in paragraph (a) (2) of this section and illustrated in Figure 5. A tensile force of 2,500 ± 25 pounds or 1,135 ± 10 kilograms shall be applied on the components in any convenient manner and the extension between anchorages under this force shall be measured. The force shall be reduced to 75 ± 5 pounds

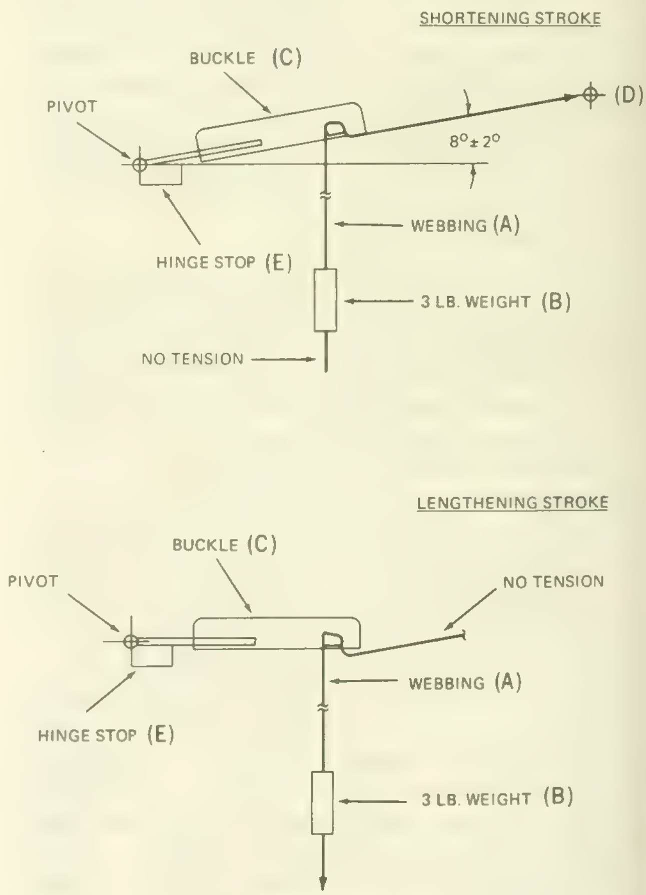


FIGURE 7

or 34 ± 2 kilograms and the buckle release force measured as prescribed in S5.2(d).

(2) The components of the upper-torso restraint shall be subjected to a tensile force of $1{,}500 \pm 15$ pounds or 680 ± 5 kilograms following the procedure prescribed above for testing pelvic restraint and the extension between anchorages under this force shall be measured. If the testing apparatus permits, the pelvic and upper-torso restraints may be tested simultaneously. The force shall be reduced to 75 ± 5 pounds or 34 ± 2 kilograms and the buckle release force measured as prescribed in S5.2(d).

(3) Any component of the seat belt assembly common to both pelvic and upper-torso restraint shall be subjected to a tensile force of $3{,}000 \pm 30$ pounds or $1{,}360 \pm 15$ kilograms.

(4) After the buckle is released in tests of pelvic and upper-torso restraints, the webbing shall be examined for cutting by the hardware. If the yarns are partially or completely severed in a line for a distance of 10 percent or more of the webbing width, the cut webbing shall be tested for breaking strength as specified in S5.1(b) locating the cut in the free length between grips. If there is insufficient webbing on either side of the cut to make such a test for breaking strength, another seat belt assembly shall be used with the webbing repositioned in the hardware. The force applied shall be $2{,}500 \pm 25$ pounds or $1{,}135 \pm 10$ kilograms for components of pelvic restraint, and $1{,}500 \pm 15$ pounds or 680 ± 5 kilograms for components of upper-torso restraint. After the force is removed, the breaking strength of the cut webbing shall be determined as prescribed above.

(5) If a Type 2 seat belt assembly includes an automatic-locking retractor or an emergency-locking retractor, the webbing and retractor shall be subjected to a tensile force of $2{,}500 \pm 25$ pounds or $1{,}135 \pm 10$ kilograms with the webbing fully extended from the retractor, or to a tensile force of $1{,}500 \pm 15$ pounds or 680 ± 5 kilograms with the webbing fully extended from the retractor if the design of the assembly permits only upper-torso restraint forces on the retractor.

(6) If a seat belt assembly has a buckle in which the tongue is capable of inverted insertion, one of the three assemblies shall be tested with the tongue inverted.

(c) *Resistance to buckle abrasion.* Seatbelt assemblies shall be tested for resistance to abrasion by each buckle or manual adjusting device normally used to adjust the size of the assembly. The webbing of the assembly to be used in this test shall be exposed for 4 hours to an atmosphere having relative humidity of 65 percent and temperature of 70° F. The webbing shall be pulled back and forth through the buckle or manual adjusting device as shown schematically in Figure 7. The anchor end of the webbing (A) shall be attached to a weight (B) of 3 pounds. The webbing shall pass through the buckle (C), and the other end (D) shall be attached to a reciprocating device so that the webbing forms an angle of 8° with the hinge stop (E). The reciprocating device shall be operated for 2,500 cycles at a rate of 18 cycles per minute with a stroke length of 8 inches. The abraded webbing shall be tested for breaking strength by the procedure described in paragraph S5.1(b).

44 F.R. 72131
December 13, 1979

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages—Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses

(Docket No. 2-14; Notice No. 4)

An amendment to Motor Vehicle Safety Standard No. 210, Seat Belt Assembly Anchorages, was published on October 1, 1970 (35 F.R. 15293). Thereafter, pursuant to § 553.35 of the procedural rules (49 CFR 553.35, 35 F.R. 5119), petitions for reconsideration were filed by Rolls Royce, Ltd., International Harvester Co., Chrysler Corp., Ford Motor Co., General Motors Corp., the Automobile Manufacturers Association, Toyota Motor Co., Ltd., American Motors, Jeep Corp., Chrysler United Kingdom, Ltd., and Checker Motors Corp.

In response to information contained in the petitions, and other considerations, certain requirements of the standard are hereby amended and the effective date of the standard with respect to passenger cars is postponed until January 1, 1972. The petitions for relief from certain other requirements of the standard are denied.

1. The effective date of the amended standard with respect to passenger cars was to have been January 1, 1971. Each petitioner claimed to be unable to produce vehicles conforming to the amended standard by that date. Those who provided lead time information indicated that several months would be needed, with estimates ranging from March 31, 1971, for Rolls Royce, to January 1, 1972, for a number of manufacturers. A January 1972 effective date would have the advantage of coinciding with the effective date proposed for the closely related interim standard on occupant crash protection (Docket 69-7, Notice 6, 35 F.R. 14941). Since the amendments with respect to passenger cars are intended primarily to enhance the enforceability of the standard rather than to provide new levels of safety, it has been determined that good cause has been shown for establishing an effective date for passenger cars of January 1, 1972.

With a single exception, the requests for postponement of the effective date of the standard with respect to multipurpose passenger vehicles, trucks, and buses, are denied. One of the primary reasons for amending the standard was to extend the protection afforded by seat belts to occupants of these types of vehicles. A postponement of effective date would leave these vehicles completely without anchorage requirements for an additional 6 months. Although manufacturers who have been installing anchorages may find it necessary to reexamine the strength and location of their anchorages, this is not considered a sufficient ground for postponing the effective date.

International Harvester requested a postponement until January 1, 1972, in the date on which upper torso restraint anchorages will be required on seats other than front seats in multipurpose passenger vehicles. On consideration of the lead time difficulties that have been demonstrated by this manufacturer, the Director regards the request as reasonable and has decided to grant the requested postponement.

2. A number of petitions requested reconsideration of the sections dealing with anchorage location. Section S4.3.1.4 of the standard states that "Anchorages for an individual seat belt assembly shall be located at least 13.75 inches apart laterally for outboard seats and at least 6.75 inches apart laterally for other seats."

General Motors stated that several of its vehicles have anchorages for the center seating position that are 6.50 inches apart, that some of

the anchorages for outboard seats are less than 13.75 inches apart, and that there is no basis either for setting a minimum spacing, or for setting different minimum spacings for different seating positions. Similar comments were made by AMA, Chrysler, Ford and American Motors.

As originally issued, Standard No. 210 had required anchorages to be "as near as practicable, 15 inches apart laterally." To make the standard more precise and more easily enforceable, the notice of September 20, 1969 (34 F.R. 14658), proposed to delete the qualifying language and to require that anchorages be 15 inches apart laterally. The comments indicated that anchorages for center seating positions, particularly the front positions, would require complete relocation. The available data on the effects of anchorage spacing were not regarded as conclusive enough to justify imposing this burden on the manufacturers, and the spacing for anchorages for inboard locations was accordingly reduced to 6.75 inches in the amended standard. Without clearer biomechanical data, the intent was to adopt the prevailing industry minimum as the standard. The same rationale applied to outboard seating position, where the 15-inch spacing was reduced to 13.75 inches.

It now appears that both spacing employed in the amended standard failed to reflect prevailing locations. The Director is accordingly amending section S4.3.1.4 to establish a minimum spacing of 6.50 inches.

A further problem with the spacing requirement arises from the use of "anchorage" as the reference point for measurement. As long as the standard used the qualifying language "as near as practicable," there was no difficulty. Removal of that phrase by the notice of September 20, 1969, created a problem of interpretation that escaped comment until after issuance of the amended standard. Several petitioners commented that they do not know what point to use for measurement. The director concedes the deficiency, and accordingly amends section S4.3.1.4 to specify that the spacing is "measured between the vertical centerlines of the bolt holes."

In conjunction with its request for a reduction of the spacing requirement, General Motors stated that where structural members between the anchorage and the seating position have the effect of spreading the seat belt loop apart, the spacing should be measured between the widest contact points on the structure. Since the strength of these structural members is not regulated, there is no assurance that their performance in a crash will be equal to that of properly spaced anchorages. The request offers no improvement in occupant crash protection, and may, in fact, diminish such protection. The request is therefore denied.

3. The amended standard's other location requirements concern the placement of anchorages to achieve desirable seat belt angles. Sections S4.3.1.1 and S4.3.1.3 each use the "nearest belt contact point on the anchorage" as the lower point defining the line whose angle is to be measured. Several petitions expressed uncertainty as to the point described, and on reconsideration the Director agrees that clarification is needed.

In the notice of proposed rule making that preceded the amended standard (34 F.R. 14658, Sept. 20, 1969) the line had been run to the "anchorage". This usage lacked precision, as stated by several comments. In an attempt to define a line that would closely approximate the actual belt angle, the language in question was adopted. The problem lies in the use of the word "anchorage", since in most installations the belt does not actually contact the anchorage. The point intended was, in fact, the nearest contact point of the belt webbing with the hardware that attaches it to the anchorage. In the typical installation, this point would be on an angle plate bolted to the anchorage. Sections S4.3.1.1 and S4.3.1.3 are accordingly amended to use the phrase "the nearest contact point of the belt with the hardware attaching it to the anchorage."

4. The test procedures of S5.1 and S5.2 were the subject of several requests for reconsideration. Most petitioners stated that the test was not representative of crash conditions, and several suggested that it should be displaced by a dynamic test. Times suggested for such a dynamic test ranged from 0.1 second to 1.0 second, and were said to be the tests used by the petitioners, or by one or another of the international standards organizations. The requirement for a 10-second hold period at maximum

load attracted the most strongly adverse comment.

From its inception, Standard No. 210 has contemplated a static test. The notice of proposed rule making of September 20, 1969, proposed a test that was clearly static, in that it involved a slow rate of load application (2 to 4 inches per minute). In response to comments that the rate was too slow, and to avoid problems of interpretation as to where the rate of pull was to be measured, the procedures were amended to specify the rate of load application in time rather than distance, with the full load reached in a period of from 0.1 to 30 seconds. It should be noted that the vehicle must be capable of meeting the requirements when tested at any rate within this range. To insure that the basic strength of the structure would be measured whatever the shape of the load application curve, a hold period of 10 seconds was specified. The procedures of the amended standard do no more than give more specific form to the test contemplated in the original standard.

The postponement of the effective date of the amended standard will provide additional time for passenger car manufacturers to assure themselves of compliance with the standard. After consideration of the issues raised in the petitions for reconsideration, the Director has concluded that the tests prescribed by the standard are reasonable, practicable, and appropriate for the affected motor vehicles. The petitions for reconsideration of sections S5.1 and S5.2 are therefore denied.

5. Two petitioners, Rolls Royce and General Motors, stated that it was not practicable to use the "seat back" in determining the angle of the torso line in S4.3.2, in that the seat back angle may vary according to which of its surfaces is measured. Although there may be instances where the angle of the seat back is difficult to determine, questions arising from such instances can be resolved, if necessary, by administrative interpretation, and it has been decided to retain the reference to "seat back" in section S4.3.2.

6. Several petitioners stated that the substitution of the word "device" for "provision" in the definition of seat belt anchorage appeared to change the meaning of that term. No substantive change was intended, and since the rewording has caused some misunderstanding, the Director has decided to return to the original wording.

7. General Motors also petitioned to reinstate the provision in section S4.3.2 that would allow the upper torso restraint angle to be measured from the shoulder to the anchorage "or to a structure between the shoulder point and the anchorage". The phrase rendered uncertain the effective angle of the belt under stress. The quoted language was deleted in the notice of September 20, 1969, and no sufficient reason has been given for reinstating it. The request is therefore denied.

8. Toyota Motor Co. requested that sections S5.1 and S5.2 be amended to allow use of body blocks equivalent to those specified. Although the standard provides that an anchorage must meet the strength requirements when tested with the specified blocks, manufacturers may use whatever methods they wish to ascertain that their products meet these requirements when so tested, as long as their methods constitute due care. If the Toyota procedures are, in fact, equivalent, there is no need to amend the standard to accommodate them. The request is therefore denied.

In consideration of the foregoing, Motor Vehicle Safety Standard No. 210, in § 571.21 of Title 49, Code of Federal Regulations is amended. . . .

Effective date. For the reasons given above, it has been determined that the effective date of the amended standard shall be January 1, 1972, for passenger cars. The effective date for multipurpose passenger vehicles, trucks, and buses shall be July 1, 1971, except that the effective date for installation of anchorages for upper torso restraints for seating positions other than front outboard designated seating positions shall be January 1, 1972.

Issued on November 20, 1970.

Charles H. Hartman,
Acting Director.

35 F.R. 18116
Nov. 26, 1970

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages and Seat Belt Installations; Reconsideration and Amendment

(Docket No. 2–14; Notice No. 4)

The purpose of this notice is to amend Motor Vehicle Safety Standards No. 208 and 210, with respect to the installation of shoulder belts in multipurpose passenger vehicles exceeding 10,000 pounds GVWR and the provision of anchorages for shoulder belts in vehicles other than passenger cars.

The seat belt installation standard was amended on September 30, 1970, to require installation of seat belts in multipurpose passenger vehicles, trucks, and buses manufactured after July 1, 1971 (35 F.R. 15222). Exemptions from the requirement for shoulder belt installation were provided for certain types and weights of vehicles.

During the course of the subsequent rulemaking activity which led to the issuance of the occupant crash protection standard, it was determined that the larger weight classes of trucks and multipurpose passenger vehicles should not be required to install shoulder belts (35 F.R. 14941, 35 F.R. 16937, 36 F.R. 4600). The standard therefore required lap belts, but not shoulder belts, for vehicles over 10,000 pounds GVWR, effective January 1, 1972. The September 30 amendment, which is to become effective six months earlier than the occupant crash protection rule, had provided a similar exemption for large trucks but not for multipurpose passenger vehicles, with the result that shoulder belts would have been required for many large multipurpose passenger vehicles during the period July 1, 1971–January 1, 1972, but not afterward. To correct this inconsistency, the seat belt installation standard is amended, effective July 1, 1971, to exempt multipurpose passenger vehicles of more than 10,000 pounds GVWR from the shoulder belt requirement.

In accordance with the foregoing, section S3.1 of Standard No. 208, as published September 30, 1970 (35 F.R. 15222) is amended effective July 1, 1971 . . . .

Standard No. 210, *Seat Belt Assembly Anchorages*, presently requires vehicles other than passenger cars to have shoulder belt anchorages installed at front outboard seating positions by July 1, 1971, and at rear outboard seating positions by January 1, 1972 (35 F.R. 15293, 35 F.R. 18116, 36 F.R. 4291). The Recreational Vehicle Institute has petitioned for an amendment of the standard, to delete the requirement for shoulder belt anchorages at positions where shoulder belt installation is not required by Standard No. 208.

It has been found that this petition has merit. The probability of shoulder belt installation by the owners of these vehicles is very small, and the difficulty of anchorage installation, particularly in multipurpose passenger vehicles, is often greater than in passenger cars. The amendment is therefore considered to be in the public interest.

The request by RVI for a postponement of the July 1, 1971, effective date for installation of shoulder belt anchorages has not been found justified, and the petition is in that respect denied.

In accordance with the foregoing, section S4.1.1 of the present Motor Vehicle Safety Standard No. 210 (effective July 1, 1971), and the amended Standard No. 210 as published November 26, 1970 (35 F.R. 18116, effective January 1, 1972), in 49 CFR 571.21, are both amended . . . .

Effective: July 1, 1971
January 1, 1972

The effective dates of the amendments made by this notice are as indicated above. Because the amendments relieve restrictions and impose no additional burden on any person, notice and request for comments on such notice are found to be unnecessary, and it is found, for good cause shown, that an effective date earlier than 180 days after issuance is in the public interest.

36 F.R. 9869
May 29, 1971

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Anchorages

(Docket No. 72--23; Notice 3)

This notice amends Safety Standard No. 210, *Seat Belt Assembly Anchorages*, to eliminate the "buckle cutout" as an optional configuration of the body block test device used for testing the strength of lap-shoulder belt anchorages, and to clarify the illustration (Figure 2) of body blocks used for testing lap belt anchorages. The optional configuration is being deleted because it unnecessarily complicates the test of the anchorages and is no longer being used by manufacturers.

Effective Date: May 18, 1978.

For Further Information Contact:

William E. Smith, Division of Crashworthiness, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2242).

Supplementary Information: Standard No. 210 (49 CFR 571.210) requires seat belt anchorages in motor vehicles to comply with specified strength requirements. The procedure for strength testing is set forth in paragraph S5 of the standard. The tests involve the attachment of a seat belt to the anchorage, followed by the application of force to the seat belt which is thereby transferred to the anchorage itself. Force is applied to Type 1 and Type 2 seat belt assemblies through body blocks that simulate the human torso. The body blocks are illustrated in Figures 2 and 3 of the standard. This notice modifies Figures 2 and 3 in accordance with the notice of proposed rulemaking issued December 16, 1976 (41 F.R. 54050).

Figure 2 describes the body block used for lap belt anchorage testing, and there has been some confusion concerning certain minor specifications in the Figure. This amendment modifies the drawing in Figure 2 to clarify the description of the body block. The change does not affect the substantive requirements of the standard in any way.

Figure 3 describes the body block used for combination shoulder and lap belt anchorage testing. An optional "buckle cutout" is shown on the surface of the body block in Figure 3, permitting a manufacturer to make an indentation in the face of the body block to accommodate buckle hardware. NHTSA compliance test experience with the cutout demonstrates that the edge of the cutout causes additional stress on the belt webbing and interferes with its movement, thereby interfering with the test of the underlying anchorage. Comments to the proposal favored deletion of the "buckle cutout" option since it is disadvantageous to manufacturers and is no longer being utilized. This amendment, therefore, deletes the optional cutout from Figure 3.

General Motors' comment recommended additional modifications of the drawing in Figure 2. The agency has determined, however, that the suggestion to add shading to define the area of the body block to be covered by foam padding does not significantly alter the clarity of the drawing. General Motors also recommended a substitute test device for the lap-shoulder belt body block. This recommendation will possibly be considered in future rulemaking.

The engineer and lawyer primarily responsible for the development of this notice are William Smith and Hugh Oates, respectively.

Since this amendment does not make any substantive change in the requirements of the standard, it is found that an immediate effective date is in the public interest.

In consideration of the foregoing, Standard No. 210, 49 CFR 571.210, is amended . . . .

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50).

Issued on May 15, 1978.

Joan Claybrook
Administrator

43 F.R. 21892
May 23, 1978

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE STANDARD NO. 210

Seat Belt Assembly Anchorages

(Docket No. 72–23; Notice 5)

Action: Final rule.

Summary: This notice amends Safety Standard No. 210, *Seat Belt Assembly Anchorages*, to eliminate the anchorage location requirements for passive seat belt assemblies that meet the frontal crash protection requirements of Safety Standard No. 208. The purpose of the amendment is to give manufacturers wider latitude in passive belt design in order to facilitate the early introduction of passive restraints in existing passenger car designs. The amendment will allow manufacturers to experiment with various passive belt designs to help determine the optimum relationship between anchorage location and passive belt effectiveness in a variety of crash modes and their comfort and convenience. Anchorage location would still be indirectly controlled by the necessity for passive belts to comply with the Standard No. 208 requirements.

Effective date: November 16, 1978.

Addresses: Petitions for reconsideration should refer to the docket number and notice number and be submitted to: Docket Section, Room 5108—Nassif Building, 400 Seventh Street, S.W., Washington, D.C. 20590.

For further information contact:

William Smith, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, Washington, D.C. 20590 (202) 426-2242.

Supplementary information: Safety Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR 571.210), specifies zones and acceptable ranges within which seat belt anchorages must be located to ensure that the anchorages are in the proper location for effective occupant restraint and specifies strength requirements to reduce the likelihood of their failure in a crash. In response to a petition from General Motors Corporation, the NHTSA issued a proposal to delete these anchorage location requirements for passive belt systems that meet the dynamic frontal crash protection requirements of Safety Standard No. 208 (43 FR 22419, May 25, 1978).

The proposal noted that General Motors would like to use a passive belt design whose anchorages, in some vehicles, would lie outside the parameters specified in the standard. GM stated that the anchorage locations of this design are intended to ensure the comfort and convenience of the passive belt so that it will not be disconnected by vehicle users who find current active belts lacking in these qualities. General Motors wanted to introduce this passive belt design prior to the effective date of the passive restraint requirements issued July 5, 1977 (42 FR 34289). As stated in the preamble of the proposal, the agency has determined manufacturers should be given wide latitude in passive belt design in order to facilitate the early introduction of passive systems, since they should save many lives and prevent hundreds to thousands of injuries. Although the current anchorage location requirements were developed primarily for active belt systems, passive belt systems such as the one used on the Volkswagen Rabbit have successfully complied with the anchorage location requirements and met the frontal injury criteria of Standard No. 208 as well. Nonetheless, manufacturers have said they can develop more effective and comfortable passive systems to comply with Standard 208. The agency thinks they should be given the opportunity. Nevertheless, it is the agency's view that research should be conducted to determine the optimum anchorage locations for the various passive belt designs in terms of both passive belt

effectiveness and of comfort and convenience for vehicle occupants. Accordingly, the earlier notice proposed the deletion of the anchorage requirements for passive belts until appropriate requirements for these systems can be developed and incorporated in the standard.

Comments in support of the proposed change were received from Chrysler, British Leyland, American Motors, Ford, Volkswagen, General Motors, and the Association Peugeot-Renault. These commenters argued that manufacturers should not be restricted in passive belt design, so that manufacturers can determine which designs are the most effective and at the same time acceptable to the public. The Center for Auto Safety argued against the proposal, however, stating that elimination of the anchorage location requirements may degrade available occupant protection.

The Center for Auto Safety agreed that manufacturers should be allowed flexibility in passive belt design to facilitate the early introduction of passive restraints. However, it argued that elimination of the forward boundary for upper torso belt anchorages may "(1) seriously degrade occupant protection available by allowing the anchorages to be installed in areas likely to be struck by the occupant in a side impact and (2) may result in systems that do not sufficiently restrain the occupant from submarining or moving laterally under the belt." The Center's first concern is that side-impact head injuries will increase if passive belt retractors, buckles, and other hardware are permitted in areas likely to be struck by the occupant's head in a side collision. The comment noted that vehicles equipped with passive belts are not required to meet the lateral impact requirements of Standard No. 208 and that manufacturers would, therefore, have no incentive to design anchorages and other hardware to avoid injuries in non-frontal collisions.

The Center's second concern is that elimination of the anchorage location requirements will allow passive belt designs that lead to more lateral occupant movement and "submarining" in side crashes, thereby increasing side impact injuries. The Center also argued that it should be the responsibility of General Motors to demonstrate the safety consequences of moving passive belt anchorages outside the current range requirements, before the agency eliminates the requirements for passive belts. Finally, the Center is concerned that once the exemption is allowed, it might be years before new location requirements for passive belts are specified.

Regarding the Center's first concern, the present requirements do not prohibit the placement of hardware in areas where they could be struck by an occupant's head in a side collision. While manufacturers may not be constrained by present standards from placing hardware where it poses a danger to occupants in side impacts, all manufacturers are on notice that the agency is preparing to propose a side impact standard as delineated in the agency's rulemaking plan. Thus, in anticipation of the upgraded side impact requirements, manufacturers should design their passive belt systems in such a way that they will not compromise side impact protection.

The Center's concern about the potential for increased lateral movement and submarining in side crashes was not supported by any data. The NHTSA is also concerned about side impact injuries. However, the existing location requirements for belt anchorages were not specifically designed to address the problem of lateral occupant motion in non-frontal collisions where the occupant is restrained by a single, diagonal passive upper torso restraint used with a knee bolster.

The notice of proposed rulemaking explicitly stated that the NHTSA intends to issue separate anchorage location requirements for passive belts following research to determine the optimum locations for passive belt effectiveness, comfort and convenience, and that the proposed exemption from the current requirements is only an interim measure. The NHTSA intends to conduct studies to look at the change in injury data resulting from displacement of the upper anchorage point of a single diagonal belt for various sizes of occupants. The research program includes testing that will investigate the "submarining" problem and, during frontal oblique impact simulations, the likelihood of excessive lateral movement. The agency will consider simulated side impact testing during this research program to evaluate potential degradation of occupant protection in this crash mode. The agency will also consider anchorage location dur-

ing the upgrading of side impact protection requirements. As stated in the recent "Five Year Rulemaking Plan," the improvement of occupant protection in side impacts is one of the NHTSA's highest priorities.

The Center's suggestion that GM demonstrate the safety consequences of passive belt anchorages should be addressed by the NHTSA's intention to look with great care at manufacturers' compliance testing of all passive belt designs to assure that these new systems will, in fact, provide at least the level of overall protection now afforded by conventional restraint systems.

Finally, regarding the Center's concern that new location requirements for passive belt anchorages will not be specified for many years, the notice of proposed rulemaking and this notice make it clear that the exemption is only an interim measure to allow improvements in passive belt designs. It is consistent, however, with the attempt to make FMVSS 208 a performance standard to the greatest extent possible. Nevertheless, should any manufacturer produce passive belt hardware or systems that cause or exacerbate injuries that would not occur with active systems currently in production, the NHTSA's safety defect authority would permit the agency to investigate such systems for possible recall and correction. Manufacturers are hereby put on notice of that fact.

In summary, the NHTSA has concluded that manufacturers should be given wide latitude in passive belt design in order to aid the early introduction of passive restraints and to aid the development of optimum designs in terms of both effectiveness and comfort and convenience. The agency agrees that anchorage location requirements are important for passive belts, but believes that more effective requirements can be developed following further research specifically involving passive belts. To ensure that safe and effective systems are being developed, the agency will be testing many of the new passive systems that will come on the market prior to the 1982 model year. In addition, the agency intends to ask manufacturers to supply data concerning the performance of passive systems in both compliance crash testing and in sled and crash testing in other modes.

The NHTSA has determined that this amendment will have no economic or environmental consequences.

The engineer and lawyer primarily responsible for the development of this notice are William Smith and Hugh Oates, respectively.

In consideration of the foregoing, Federal Motor Vehicle Safety Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR 571.210), is amended . . . .

AUTHORITY: (Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on November 3, 1978.

Joan Claybrook
Administrator

43 F.R. 53440
November 16, 1978

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Anchorages for Child Restraint Systems
[Docket No. 80-18; Notice 4]

ACTION: Final Rule.

SUMMARY: To permit the securing of child safety seats, this notice amends Standard No. 210, *Seat Belt Assembly Anchorages,* to require all vehicles with automatic restraint systems at the right front passenger seating position to be equipped with anchorages for a lap belt at that position if the automatic restraint cannot be used to secure a child safety seat. Some automatic belts cannot be used to secure child safety seats since they include only a single, diagonal shoulder belt. The new requirement will enable parents to install a lap belt if they wish to secure a child safety seat in the front right outboard seating position. The amendment also requires vehicle manufacturers to include information in their owner's manuals on child safety and the location of shoulder belt anchorages in the rear seats. The owner's manual must also provide instructions explaining how a lap belt can be installed for use with child safety seats in the front right passenger seating position in vehicles with automatic restraints that cannot be used for securing child restraints.

EFFECTIVE DATE: The effective date for all of the amendments, except for the amendments adding S6 and S7 to the standard, is September 1, 1987. The amendments adding S6 and S7 contain information collection requirements which must be approved by the Office of Management and Budget (OMB). After OMB approval, the agency will publish a notice announcing the effective date of S6 and S7 of the standard.

SUPPLEMENTARY INFORMATION: On December 11, 1980 (45 FR 81625), NHTSA issued a notice of proposed rulemaking to amend Standard No. 210, *Seat Belt Assembly Anchorages,* to require anchorages in certain vehicles for child safety seat tether straps. In addition, the notice proposed requiring vehicles equipped with automatic restraint systems at the right front designated seating position, which cannot be used for the securing of child safety seats, to have separate anchorages at that position for the installation of Type 1 lap belts.

On July 5, 1985 (50 FR 27632) the agency published a notice terminating the portion of the proposed rule concerning anchorages for child safety seat tether straps. As explained in that notice the agency has decided that the appropriate way to reduce problems created by tether misuse is to propose an amendment (50 FR 27633) to Standard No. 213, *Child Restraint Systems* to require all child safety seats to pass a 30 mile per hour simulated crash test without a tether attached. This will ensure that all child safety seats provide an adequate level of safety even if they designed to be used with a tether strap. This notice announces the agency decision on the remaining portion of the proposed rule relating to front passenger seat safety belt anchorages.

Lap Belt Anchorages for Front Seats

A large percentage of the commenters supported the proposed requirement on the basis that some provision is necessary for securing child restraint systems used in front right seating positions, especially in vehicles with single, diagonal automatic belt designs. Several commenters noted that, in particular, infant safety seats are often used in that seat so that the infant is within view and reach of an adult. However, several commenters stated that the proposal did not go far enough. Some commenters recommended that in addition to requiring holes for anchorages, the agency should require anchorage hardware to be installed by vehicle manufacturers so that lap belts could be readily installed by consumers. Other commenters recommended that lap belts be required for these positions in addition to the anchorages.

A few commenters argued that the proposed anchorages should not be required at all because the

rear seat is the safest location for the transportation of children and the proposal would encourage parents to place their children in the less safe front seat. Several commenters also requested that the anchorage strength for the lap belt anchorages be set at 3,000 pounds rather than the proposed 5,000 pounds, on the basis that the lap belts would only be used to restrain children, not adults.

The agency agrees that the installation of lap belts in front seating positions not currently having them (vehicles equipped with single, diagonal automatic belts or with nondetachable automatic belts that cannot be used for attachment of child safety seats) would be the optimum situation inso far as securing child safety seats is concerned. Short of this, requiring complete attachment hardware would make the installation of lap belts somewhat easier than if manufacturers only provide anchorage holes. However, both of these approaches involves costs that the agency believes are not justified because of the limited number of vehicle owners who would actually have need of this equipment.

The cost of requiring the actual anchorage hardware in addition to providing threaded anchorage holes would be approximately $.30 for each vehicle, and the cost of requiring the lap belts to be installed would be approximately $14.00 per vehicle. If lap belts or anchorage hardware were required, many owners would be paying for equipment they do not need. The agency does not believe these costs are justified since the presence of the threaded hole will allow those vehicle owners who actually have need of lap belts to easily install them. The agency has therefore decided to require only threaded anchorage holes to be present. With the threaded holes present, the attachment hardware and lap belt can be installed in a short time.

Type of Threaded Holes

Several commenters objected to the proposed requirement that the anchorage holes be threaded to accept one specific type of bolt for attaching a lap belt. They said that Standard No. 209, *Seat Belt Assemblies,* permits the use of several types of bolts and argued that specifying the use of only one type of bolt would be restrictive. The agency agrees that manufacturers should have the same design flexibility as provided by Standard No. 209. Therefore, the final rule provides that manufacturers can thread the anchorage holes to accept any one of the bolts permitted by Standard No. 209.

Anchorage Strength

With regard to anchorage strength, the agency believes that the lap belt anchorages required by this amendment should comply with the 5,000 pound requirement currently specified in Standard No. 210 for Type 1 lap belts, rather than the 3,000 pound requirement recommended by some commenters. It is true that certain "special" lap belts designed only for use by children might not need to meet a 5,000 pound strength requirement. However, since only anchorage holes are required, some persons may install typical lap belts which will be at times, likely used by adults. Adults might also use the "special" lap belt designed only for use by children, thinking that it is intended for use by anyone. For these reasons, the agency believes it is important for the anchorage strength to be sufficient to withstand the 5,000 pound force that could be generated by an adult in a crash. The agency is therefore adopting a 5,000 pound strength requirement.

Information in the Owner's Manual

The notice of proposed rulemaking proposed that the owner's manual in each vehicle provide specific information about protecting children in motor vehicles. It proposed that each owner's manual explain how to use a vehicle lap belt to secure a child safety seat, alert parents that children are safer in the rear seats, particularly in the center rear seat, and have a specific warning about the need to use infant and child safety seats. All 50 States and the District of Columbia now require children to be fastened into child safety seats. The notice also propose that the owner's manual provide information about the proper installation of a lap belt in the front right passenger seating position of a vehicle with an automatic restraint that cannot be used to secure a child safety seat. In addition, the notice proposed that the owner's manual identify the location of the shoulder belt anchorages that are currently required by the standard for outboard rear seating positions.

Several commenters said that recommendations concerning the proper use of lap belts for attachment of child safety seats should be given by the child safety seat manufacturer rather than the vehicle manufacturer. They said that the child safety seat manufacturer is more knowledgeable about the proper use of its product. The agency agrees and notes that all child safety seat manufacturers currently provide such information. Ac-

cordingly, vehicle manufacturers will only be required to have a section in the owner's manual referring to the importance of properly using the vehicle belts with child safety seats and will not have to provide specific information about the use of belts with each type of child safety seat.

Other commenters expressed concern about the proposed requirement that vehicle manufacturers state that the center rear seat is the safest position to secure a child safety seat. The commenters noted that many vehicles currently do not have a center rear seat. Other commuters objected to including the information in owner's manuals of vehicles that do not have a rear seat. The agency agrees with these objections and has therefore modified the requirement so that vehicles with no rear seats do not have to include the statement and in vehicles with no center rear seat, a manufacturer only has to state that the rear seat is the safest position. Several commenters argued that the agency should not require manufacturers to provide information in the owner's manual since the agency's noncompliance notification and remedy regulations would then apply. They recommended that the manufacturers voluntarily provide the information.

The agency recognizes that the proposed warning requirement, which would have required manufacturers to use specific wording on child safety in the owner's manual, could lead to situations where manufacturers would have to file petitions for inconsequentiality for minor variations in the wording. At the same time, the agency believes it is important that vehicle owners receive general information on child safety and specific information on installing lap belts at the right front seat. Thus manufacturers will still have to provide information about protecting children. However, the agency has decided against requiring a warning with prescribed wording about child safety in all owner's manuals, so as to give manufacturers the maximum flexibility to incorporate that information effectively.

Finally, the agency is adopting, as proposed, the requirement that the owner's manual provide information about the location of the shoulder belt anchorages for the rear seat. Several commenters said that few people are aware that the anchorages are currently present and therefore do not know that shoulder belts can be installed in rear seats. No commenter objected to this proposal.

Effective Date

The safety belt anchorage requirements included in this amendment become effective September 1, 1987. In response to the notice of proposed rulemaking, various vehicle manufacturers indicated leadtime needs of one year, 18 months, two years and three years. Those estimates, however, reflected the time necessary for designing, tooling and installing tether anchorages rather than for the simpler task of providing additional lap belt anchorages. Standard No. 210 currently requires anchorages for a Type 2 lap-shoulder safety belt (an inboard and an outboard floor anchorage for the lap portion of belt and an outboard anchorage for the upper torso belt) at each front outboard seating position, even if the vehicle is equipped with a single, diagonal automatic belt. However, the inboard anchorage of some diagonal belts is not suitable for attachment of a lap belt since the anchorage is designed only to accommodate an automatic belt. The amendment adopted today would require, for some vehicles, the addition of one more anchorage (an additional inboard anchorage) than currently required. For any vehicles which have a three point nondetachable automatic belt that cannot be used, two additional anchorages may be required. After a careful consideration of all comments and an evaluation of the necessary design changes and tooling requirements, the agency has concluded that a leadtime of one year should be sufficient. However, if the rule were to go into effect in mid-model year, the tooling and other costs associated with the rule will substantially increase. Therefore, the agency has decided that there is good cause for making the rule effective on September 1, 1987. A leadtime of longer than a year is in the public interest since it will serve to reduce the cost of the rule to manufacturers and consumers.

Issued on October 4, 1985.

Diane K. Steed
Administrator

50 FR 41356
October 10, 1985

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages
(Docket No. 80-18; Notice 5)

ACTION: Final Rule; Response to petitions for reconsideration.

SUMMARY: This notice responds to two petitions for reconsideration of the amendments to Standard No. 210, *Seat Belt Assembly Anchorages*, published on October 10, 1985. Those amendments required manufacturers to provide anchorages for a lap safety belt in automatic-restraint equipped vehicles in which the automatic restraint system cannot be used to restrain a child safety seat. In addition, the amendments required manufacturers to provide certain safety information in their vehicle owner's manual describing how to install the lap belt. Also, the owner's manual was to state that children are safer when properly restrained in the rear seating positions than in front seating positions and that, in a vehicle with a rear seating position, the center rear seating position is the safest. Two manufacturers, American Motors Corporation (AMC) and Toyota Motor Corporation (Toyota), filed timely petitions seeking reconsideration of those amendments. In response to AMC's petition, the agency has amended the lap belt anchorage requirement to make it clear that if a manufacturer voluntarily provides a manual lap or lap/shoulder belt at the front right passenger's seat, it does not have to provide an additional set of anchorages. AMC's remaining requests to permit the use of self-tapping safety belt anchorage bolts and to extend the September 1, 1987, effective date are denied. Toyota's request to delete the requirement that manufacturers state that the center rear seat is the safest seating position is granted.

EFFECTIVE DATE: The amendments made by this notice are effective on August 19, 1986. Manufacturers do not have to comply with the requirements of S4.1.3, S6, and S7 until September 1, 1987.

SUPPLEMENTARY INFORMATION: On October 10, 1985 (43 FR 53364), NHTSA published a final rule amending Standard No. 210, *Seat Belt Assembly Anchorages*. The amendments require manufacturers to provide anchorages for a lap belt at the front right seat in vehicles manufactured after September 1, 1987, if the vehicle is equipped with an automatic restraint system that cannot be used to restrain a child safety seat. In addition, the amendments require manufacturers to provide safety information in their vehicle owner's manuals on the proper installation of lap belts in vehicles equipped with the supplemental lap belt anchorages. Also, the owner's manual was to state that children are safer when properly restrained in the rear seating positions than in front seating positions and that, in a vehicle with a rear seating position, the center rear seating position is the safest. Two vehicle manufacturers, AMC and Toyota, filed timely petitions seeking reconsideration of those amendments. In the following discussion, NHTSA addresses the issues raised by the petitioners.

Anchorage Requirements

AMC said that the language of the lap belt anchorage requirement of S4.1.3 of the standard could be "construed to mean that the supplemental anchorages might be required, *even if* a lap belt is present." The NHTSA explained in the preamble to the October 1985 final rule that the purpose of the anchorage requirement is to enable vehicle owners to quickly and easily install a lap belt to secure a child safety seat in the front right passenger's seat. The agency agrees with AMC that clearly if a manufacturer has already provided a lap belt at that position, there is no need for the supplemental anchorages. NHTSA has amended the language of the standard to clarify the requirement by providing that a manufacturer can, at its option, provide either the supplemental anchorages or a manual lap or lap/shoulder belt.

Modification of Automatic Belt Systems

AMC also asked the agency to allow manufacturers to provide methods, other than lap belt anchorages, to enable vehicle owners to secure child

safety seats. AMC said that one "possible approach would be the adaptation of the automatic restraint system to secure a child restraint. For example, for a two-point automatic belt with a door-mounted emergency release, the manufacturer could include instructions to the owner on the installation of a buckle on the lower outboard anchorage. The automatic belt could then be released from the door, and buckled at the floor to form a lap belt." AMC said that it was "not necessarily recommending the use of these systems, because the questions of cost, adult misuse, etc., all must be addressed."

As NHTSA explained in the preamble to the October 1985 final rule, the purpose of the amendment is to address the problems associated with securing a child safety seat in some types of automatic restraint systems. For example, some automatic safety belts cannot be used to secure child safety seats either because they have only a single diagonal shoulder belt or because they are nondetachable and thus cannot be threaded through the structure of the child safety seat to hold the safety seat in place. By requiring manufacturers to provide threaded anchorage holes in those vehicles, the agency believed that vehicle owners who wanted to install a lap belt at the front right seat could easily and quickly do so by taking the simple step of threading a bolt into the anchorage.

NHTSA agrees with AMC that it would not be necessary to require the additional lap belt anchorages, if the vehicle owner can adjust the automatic belt system so that it can effectively restrain a child safety seat. NHTSA believes that the ease and simplicity of the adjustment is crucial. The agency does not want vehicle owners to have to follow complicated instructions or have to obtain special tools or have to purchase and install special attachment (other than the belt itself) hardware before they can use the automatic belt system to restrain a child safety seat. The more difficult and complicated the procedure is, the greater the possibility that a vehicle owner may improperly adjust the automatic belt system. In contrast, if a vehicle manufacturer has installed the additional hardware necessary to allow the use of the automatic belt to restrain a child safety seat and all a vehicle owner has to do is simply operate the emergency release for the automatic belt and then reconnect it to the attachment hardware provided by the manufacturer, NHTSA believes that vehicle owners can quickly, easily, and safely use the automatic belt to restrain a child safety seat. Thus, the agency is amending the language of S4.1.3 to provide that a manufacturer does not have to install threaded anchorage holes if it has installed all the necessary hardware needed to adjust the automatic safety belt to secure a child safety seat.

With this amendment, manufacturers now have three options for securing child safety seats in automatic restraint equipped vehicles. First, they can provide an automatic restraint that can be used, with no modifications, to secure a child safety seat. Alternatively, they can provide an automatic restraint that can be modified or adjusted by the vehicle owner to secure a child safety seat, as long as the manufacturer has installed all the hardware necessary to secure the child safety seat. Finally, a vehicle manufacturer has the alternative of, at its option, installing a manual lap or lap/shoulder belt with its automatic restraint system or providing threaded holes so that the vehicle owner can install a manual lap belt. The agency believes that these three alternatives give a substantial amount of flexibility to vehicle manufacturers to determine which approach they want to use and assures that vehicle owners can quickly, easily, and safely use child safety seats in the front right seats of automatic restraint equipped vehicles.

Threaded Holes

The final rule required manufacturers to provide threaded holes that would accept a bolt complying with Standard No. 209, *Seat Belt Assemblies.* AMC explained that it does not use a threaded nut in its safety belt assembly, but instead uses a self-tapping bolt. It said use of the self-tapping bolt eliminates the possibility of cross-threading or misalignment caused by paint on the thread of the nut. AMC asked that the requirement be changed from providing threaded holes to providing holes that will accept any type of safety belt hardware.

NHTSA specified the installation of a threaded hole so that a vehicle owner could quickly, easily, and safely install a lap belt without using special tools or purchasing special attachment hardware. The agency expected that with the threaded holes, a vehicle owner could, if need be, find the appropriate bolt at a hardware store and install the bolt with a simple wrench or pliers. The agency is concerned that a self-tapping bolt of sufficient size and strength to withstand the forces imposed by a safety belt is not commonly available. In addition, it may be more difficult for a vehicle owner to properly align a self-tapping bolt and exert sufficient force to drive the bolt through the steel floor

without a special tool. Therefore, NHTSA has decided to deny AMC's request, and instead retain the requirement that manufacturers provide threaded holes.

Leadtime

Saying that its petition sought several changes which will impact the design of its vehicles, AMC requested the agency to provide additional leadtime to implement any changes adopted by the agency. The agency does not believe that any additional leadtime is necessary. As adopted, the rule provided nearly two years of leadtime. AMC has provided no new information to show that it cannot meet the requirements of the rule within that period of time. Therefore, NHTSA has decided to deny AMC's request for additional leadtime.

Owner's Manual Information

The October 1985 final rule requires manufacturers to provide certain information in their owner's manuals about securing child safety seats in their vehicles. Among the requirements is one that, in vehicles with a center rear seat, manufacturers must state in the owner's manual that the center rear seat is the safest. Toyota asked the agency to reconsider that requirement.

Toyota agrees that children are safest when properly restrained in the rear seat, but it said it does not have data to show the center rear seat is always the safest. In addition, Toyota said that in a vehicle with front bucket seats, "depending how a child is restrained in the center rear seating position, he or she could hit against the console box and or the transmission shift lever, which are more solid than the front seatbacks." Finally, Toyota said that the required statement might mislead persons into thinking that the center rear seat is the safest, regardless of how an occupant is restrained.

NHTSA decided to require a statement about the safety of the center seat in the owner's manual based on crash tests and accident data which show that the center rear seat is safer, particularly in side impacts, than other seats. For example, side impact crash tests conducted for the agency have shown that, as would be expected, test dummies closer to the struck side of the vehicle experience larger acceleration than dummies seated away from that side. In addition to experiencing larger accelerations, the test dummies located closer to the side door contacted the interior of the vehicle as it crushed inward during the impact. (See, for example, "Countermeasures for Side Impact," DOT Contract HS 9-02177.)

Likewise, accident data have generally shown that the center rear seat is the safest. For example, data on injuries to unrestrained occupants show that occupants of center seating positions have fewer serious injuries and fatalities than unrestrained occupants in outboard rear seats. (See, "Usage and Effectiveness of Seat and Shoulder Belts in Rural Pennsylvania," DOT Publication HS 801-398). Data on restrained occupants in the rear seats are more limited. The Canadian Ministry of Transport analyzed data on the fatality and injury rates in Ontario and Alberta for the years 1978–1980. The Alberta data show, for example, that restrained children (birth–14 years old) riding in the center rear seat had the lowest rate of major and fatal injuries. Likewise, the Ontario data showed that restrained children (birth–14 years old) riding in the center rear seat had the lowest rate of major and fatal injuries. Likewise, the Ontario data showed that restrained children (birth–14 years old) riding in the center rear seat had the lowest fatality rate. NHTSA acknowledges that because of the small amount of information available on injuries and fatalities to restrained children in the rear seat, the results should not be regarded as conclusive.

NHTSA does not have sufficiently detailed files on real-world crashes to be able to address Toyota's statement that for vehicles with bucket seats it is possible that, depending on how a child is restrained, he or she could strike the console box or other vehicle features that are harder than the seatback. The agency also has not done any crash testing of bucket seat vehicles with child test dummies restrained in the rear seat. The agency agrees, however, that depending on how a child is restrained and the severity of the crash, it is possible for a restrained child in the center rear seat of a bucket seat vehicle to strike a portion of the vehicle's interior in front of the child. Therefore, the agency has decided to grant Toyota's petition and has deleted the requirement in S6(b) that manufacturers state that the center rear seat is the safest seating position. NHTSA anticipates that if a manufacturer has a particular concern about a design feature in its bucket seat equipped vehicles that could be struck by a properly restrained child, the manufacturer would take steps to minimize the risk posed by the design feature.

Navistar International Corporation (Navistar) has recently written the agency concerning the applicability of the owner's manual requirements to

vehicles with a gross vehicle weight rating (GVWR) of more than 10,000 pounds. Navistar said that such heavy vehicles are generally property-carrying and service vehicles used for commercial purposes and would seldom, if ever, be carrying children. Navistar also noted that the drivers of those heavy vehicles may never see the owner's manual, since they may not be the owners of the vehicles.

The agency believes that Navistar has raised several good reasons why the owner's manual requirements should be limited to vehicles with a GVWR of 10,000 pounds or less, the class of vehicle which would normally be transporting children in child safety seats. Thus, the agency is amending the standard to limit the owner's manual requirements to vehicles with a GVWR of 10,000 pounds or less.

The agency is also making another minor clarifying change to the owner's manual information requirements.

S6(c) of the standard requires vehicle manufacturers to provide information about the location of the anchorages for shoulder belts in the rear outboard seats in their vehicles under the following conditions. Manufacturers are required to provide the owner's manual information if Standard No. 210 requires them to install shoulder belt anchorages at those positions and they have not installed lap/shoulder belts at those positions as items of original equipment. Since S4.1.1 of Standard No. 210 only requires the installation of shoulder belt anchorages in the rear outboard seats of passenger cars, the agency is amending S6(c) to make clear that this portion of the owner's manual requirements only apply to passenger cars.

For the reasons set out in the preamble, section 571.210 of Title 49 of the Code of Federal Regulations is amended as follows:

1. The authority citation for Part 571 would continue to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

2. S4.1.3 is amended by revising the first sentence to read as follows:

S4.1.3 Notwithstanding the requirement of paragraph S4.1.1, each vehicle manufactured on or after September 1, 1987, that is equipped with an automatic restraint at the front right outboard designated seating position that cannot be used for securing a child restraint system or cannot be adjusted by the vehicle owner to secure a child restraint system solely through the use of attachment hardware installed as an item of original equipment by the vehicle manufacturer shall have, at the manufacturer's option, either anchorages for a Type 1 seat belt assembly at that position or a Type 1 or Type 2 seat belt assembly at that position.

3. The first sentence of S6 is revised to read as follows:

S6 *Owner's Manual Information.* The owner's manual in each vehicle with a GVWR of 10,000 pounds or less manufactured after September 1, 1987, shall include:

4. S6(b) is revised to read as follows:

(b) In a vehicle with rear designated seating positions, a statement alerting vehicle owners that, according to accident statistics, children are safer when properly restrained in the rear seating positions than in the front seating positions.

5. S6(c) is revised to read as follows:

(c) In each passenger car, a diagram or diagrams showing the location of the shoulder belt anchorages required by this standard for the rear outboard designated seating positions, if shoulder belts are not installed as items of original equipment by the vehicle manufacturer at those positions.

6. S7 is revised to read as follows:

S7 *Installation Instructions.* The owner's manual in each vehicle manufactured on or after September 1, 1987, with an automatic restraint at the front right outboard designated seating position that cannot be used to secure a child restraint system when the automatic restraint is adjusted to meet the performance requirements of S5.1 of Standard No. 208 shall have:

(a) A statement that the automatic restraint at the front right outboard designated seating position cannot be used to secure a child restraint and, as appropriate, one of the following three statements:

(i) A statement that the automatic restraint at the front right outboard designated seating position can be adjusted to secure a child restraint system using attachment hardware installed as original equipment by the vehicle manufacturer;

(ii) A statement that anchorages for installation of a lap belt to secure a child restraint system have been provided at the front right outboard designated seating position; or

(iii) A statement that a lap or manual lap or lap/shoulder belt has been installed by the vehicle manufacturer at the front right outboard designated seating position to secure a child restraint.

(b) In each vehicle in which a lap or lap/shoulder belt is not installed at the front right outboard designated seating position as an item of original equipment, but the automatic restraint at that position can be adjusted by the vehicle owner to secure a child restraint system using an item or items of original equipment installed in the vehicle by the vehicle manufacturer, the owner's manual shall also have:

(i) A diagram or diagrams showing the location of the attachment hardware provided by the vehicle manufacturer.

(ii) A step-by-step procedure with a diagram or diagrams showing how to modify the automatic restraint system to secure a child restraint system. The instructions shall explain the proper routing of the attachment hardware.

(c) In each vehicle in which the automatic restraint at the front right outboard designated seating position cannot be modified to secure a child restraint system using attachment hardware installed as an original equipment by the vehicle manufacturer and a manual lap or lap/shoulder belt is not installed as an item of original equipment by the vehicle manufacturer, the owner's manual shall also have:

(i) A diagram or diagrams showing the locations of the lap belt anchorages for the front right outboard designated seating position.

(ii) A step-by-step procedure and a diagram or diagrams for installing the proper lap belt anchorage hardware and a Type 1 lap belt at the front right outboard designated seating position. The instructions shall explain the proper routing of the seat belt assembly and the attachment of the seat belt assembly to the lap belt anchorages.

Issued on August 12, 1986

Diane K. Steed
Administrator

51 F.R. 29552
August 19, 1986

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages— Passenger Cars, Multipurpose Vehicles, Trucks and Buses (Docket No. 87-08; Notice 3) RIN 2127-AB 9

ACTION: Final rule.

SUMMARY: This rule establishes a new requirement for lap/shoulder safety belts to be installed at all forward-facing rear outboard seating positions in passenger cars. Rear-seat lap/shoulder belts are estimated to be even more effective than rear-seat lap-only belts in reducing fatalities and moderate-to-severe injuries. As safety belt use in the rear seat increases, the greater effectiveness of rear-seat lap/shoulder belts should yield progressively larger benefits in terms of reduced fatalities and moderate-to-severe injuries. NHTSA anticipates that this rule requiring rear-seat lap/shoulder belts will help increase safety belt use in the rear seats, by providing rear-seat occupants with maximum safety protection when they buckle up.

DATES: This final rule takes effect on December 11, 1989. All passenger cars, other than convertibles, manufactured on or after that date must be equipped with rear-seat lap/shoulder belts that comply with this rule.

SUPPLEMENTARY INFORMATION: Standard No. 208, *Occupant Crash Protection* (49 CFR § 571.208) currently requires vehicle manufacturers to install a seat belt assembly that conforms to Standard No. 209, *Seat Belt Assemblies,* at every rear designated seating position in passenger cars, trucks, and multipurpose passenger vehicles. Manufacturers are permitted to choose between installing a Type 1 (lap-only) or Type 2 (lap/shoulder) safety belt system. Until recently, most manufacturers chose to comply with this requirement by installing lap-only safety belts at rear designated seating positions.

When the agency gave manufacturers the option of installing either a lap-only or lap/shoulder belt at each rear designated seating position, the available evidence showed that both types of belt systems were effective in reducing the risk of death and serious injury in a crash. A number of studies since that time have evaluated thousands of cases and repeatedly concluded that lap-only belts are, in fact, substantially effective in preventing deaths and reducing injuries. While there are individual cases where lap-only belts may have failed to prevent injury, NHTSA knows of no comprehensive study by any person or organization that concludes that rear-seat lap belts are anything less than effective in reducing overall crash risks for those occupants. The agency again strongly encourages rear-seat occupants to use whatever type of safety belt is available, whether lap-only or lap/shoulder, just as front-seat occupants should always buckle up.

Even so, NHTSA believes that lap/shoulder belts would be even more effective than lap-only belts in rear seating positions. In past years, however, rear-seat occupants infrequently used their safety belts, which were almost always the lap-only type, with usage rates far lower than for front-seat occupants. For example, approximately 2 percent of rear seat occupants wore their safety belts in 1981-82. With that very low rate of belt use, the safety benefits (in terms of reduced deaths and injuries) of lap/shoulder belts vs. lap-only belts at those rear seating positions would have been negligible, but would have imposed substantially greater costs. In 1984, NHTSA estimated the cost differential to be an additional $20 per rear seating position equipped with lap/shoulder belts. After considering these facts, and the far greater need for improved front seat occupant protection, the agency decided that it could not then justify a requirement for lap/shoulder belts at rear seating positions.

In August 1986, a petition was filed with the agency by the Los Angeles Area Child Passenger Safety Association. This petition asked NHTSA to require the installation of lap/shoulder belts in rear seating positions. The agency decided to grant this petition and reexamine the issue. Accordingly, on June 16, 1987, NHTSA published an advance notice of proposed rulemaking (ANPRM), requesting comments on the need for rulemaking to require lap/shoulder belts in rear seating positions (52 FR 22818). Thirty-four commenters responded to the ANPRM.

After considering these comments, NHTSA concluded that several factors had changed since the previous considerations of this subject. Among the changed factors were the following:

1. *Safety Belt Use in Rear Seating Positions Had Increased Substantially.* Safety belt use in rear seats had increased eightfold from the 2 percent use rate in 1981–82 to 16 percent use in 1987. The primary factors responsible for the dramatic increase in safety belt use were State safety belt use laws. As of April 1989, these laws were in place in 32 States and the District of Columbia. As the number of States with safety belt use laws continues to grow, along with expanded belt-use campaigns and greater public awareness of the benefits of wearing safety belts, there is every reason to believe that the rate of belt use by rear-seat occupants will continue to increase as well.

2. *The Greater Effectiveness of Rear Seat Lap/Shoulder Belts Had Become a Significant Factor With the Increase in the Use of Rear Seat Belts.* NHTSA estimates that rear-seat lap-only belts are 32 percent effective in reducing the risk of death, while rear-seat lap/shoulder belts would be 41 percent effective in reducing the risk of death. As more rear-seat occupants use their safety belts, the 9 percentage point greater effectiveness for lap/shoulder belts will result in progressively greater safety benefits.

3. *As Manufacturers Voluntarily Chose to Equip Their Vehicles With Rear Seat Lap/Shoulder Belts, the Costs Associated With a Requirement for Rear-Seat Lap/Shoulder Belts Were Proportionally Diminished.* When the agency examined this issue on previous occasions, the vast majority of vehicles were equipped with lap-only safety belts at rear seating positions. The costs of adding lap/shoulder safety belts to the rear seating positions of nearly every new vehicle were substantial. In preparing the ANPRM on this subject, NHTSA assumed that rear outboard seat lap/shoulder belts would not otherwise be installed in passenger cars unless required by regulation, and estimated the total costs for equipping the new-car fleet to be approximately $140 million annually.

However, vehicle manufacturers have voluntarily chosen to equip more and more of their vehicles with rear-seat lap/shoulder belts. For example, nearly every 1990 model year passenger car would have been voluntarily equipped with rear outboard seat lap/shoulder belts. The incremental costs associated with a NHTSA requirement would reflect only the costs of installing rear-seat lap/shoulder belts in the small portion of the fleet that would not have those belts voluntarily installed, or approximately $790,000, a substantial decrease from the agency's previous estimates of such costs.

After analyzing the effects of these changed factors and the comments received on the ANPRM, NHTSA tentatively determined that a requirement for lap/shoulder belts in rear seating positions would now be justified. Accordingly, NHTSA published a notice of proposed rulemaking (NPRM) on November 29, 1988 (53 FR 47982). This NPRM was a comprehensive proposal. It proposed to require that all passenger cars, other than convertibles, manufactured on or after September 1, 1989, be equipped with lap/shoulder safety belts at all forward-facing rear outboard seating positions. It proposed further that convertible passenger cars and trucks, multipurpose passenger vehicles, and buses with a gross vehicle weight rating of 10,000 pounds or less manufactured on or after September 1, 1991, be equipped with lap/shoulder safety belts at all forward-facing rear outboard seating positions. The NPRM also proposed that rear-seat lap/shoulder belts be equipped with a particular type of retractor, that such belts be integral (i.e., the lap belt could not be detachable from the shoulder belt), that rear-seat lap/shoulder belts comply with some of the comfort and convenience requirements specified in section S7.4 of Standard No. 208, and that the anchorages for the rear-seat lap/shoulder belt assemblies comply with the requirements of Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR § 571.210).

The comment period for the NPRM closed on January 30, 1989. More than 70 comments were received on the NPRM. The commenters generally agreed with the proposal to require lap/shoulder belts at forward-facing rear outboard seating positions, at least in passenger cars other than convertibles. However, the commenters raised a number of concerns with and objections to specific details of the NPRM, including the vehicle types other than passenger cars that should be required to be equipped with rear-seat lap/shoulder belts, the retractors with which those lap/shoulder belts should be equipped, compatibility with child restraint systems, the definition of an "outboard seat," the details of the comfort and convenience requirements, and the requirements for tension-relieving devices on these belts.

NHTSA will need some additional time to properly analyze and evaluate each of these comments on the detailed aspects of the proposal, and to formulate the agency response and appropriate regulatory requirements for each of these aspects. If the agency were to take no final rulemaking action while it is preparing its position on each of these issues, the effect would be to delay the issuance and effective date of the basic requirement to install rear-seat lap/shoulder belts in all vehicles including passenger cars. Yet it is this basic requirement that will offer the public most of the safety benefits that were contemplated by the agency when it published the NPRM. While NHTSA believes that additional incremental safety benefits will result

from requirements adopting detailed installation requirements, such as those proposed in the NPRM, it would appear unwise and inappropriate for the agency to deny the public the benefits of a basic requirement for rear-seat lap/shoulder belts until the agency can complete its work on those installation requirements.

To ensure the earliest possible implementation of a requirement for rear-seat lap/shoulder belts, NHTSA has decided to take final action on its proposal in two steps. The first step consists of this rule, which addresses only passenger cars other than convertibles with a general requirement for lap/shoulder belts at rear outboard seating positions. The second step will consist of NHTSA's decision regarding each of the detailed proposals for rear-seat lap/shoulder belts set forth in the NPRM. NHTSA will also treat the second step of this rulemaking as a high priority action, to ensure that the incremental benefits are available in a timely fashion.

With the exception of Ford Motor Company (Ford) and Subaru, the commenters were essentially unanimous in their support for the agency's proposal to require rear-seat lap/shoulder belts in all 1990 and subsequent model year passenger cars other than convertibles.

Ford commented that it had planned to voluntarily provide rear-seat lap/shoulder belts in most of its cars by September 1, 1989, regardless of any regulatory requirements. However, Ford stated that it had not planned to provide rear-seat lap/shoulder belts in one of its car lines by that date, because production of the current design of that line will be phased out during the 1990 model year. Accordingly, Ford commented that "a 1989 effective date might well compel Ford to stop production of that line," but that Ford could meet the proposed passenger car requirements for all its cars manufactured on or after September 1, 1990. NHTSA contacted Ford to obtain more detailed information about these assertions.

Ford explained that its asserted problem arose from the proposed requirement that rear-seat lap/shoulder belts be integral. However, Ford did plan to offer retrofit shoulder belt kits for the rear seats of the single line which it was not planning to equip with rear-seat lap/shoulder belts for the 1990 model year. These retrofit kits would consist of separate manually adjustable shoulder belt and buckle assemblies to supplement the lap-only belts already installed in the vehicle. The installation of these retrofit kits involves no change to the existing lap belts. Instead, the upper ends of the shoulder belts are attached to the upper anchorages required by Standard No. 210 to be in the car at all forward-facing rear outboard seating positions. The lower ends of the shoulder belts are attached to the inboard anchorages for the existing lap belts, by loosening the bolt anchoring the lap belt, inserting the attachment hardware for both the lap belt and the shoulder belt on that bolt, and then retightening and properly torquing the bolt. After the retrofit, the installed safety belt system consists of a lap belt with its own buckle and retractor, and a shoulder belt with its own buckle and manual adjusting device. Such a design would not comply with the proposed requirement that the lap/shoulder belts be integral.

Ford asserted that it could not comply with a requirement for *integral* lap and shoulder belts for the rear outboard seating positions of this single line. According to Ford, it would not be acceptable simply to use an integral lap/shoulder belt assembly and attach the upper end of the shoulder belt assembly to the anchorages installed in the car in compliance with Standard No. 210. While such a system would comply with the applicable and proposed NHTSA regulatory requirements, Ford indicated that such a safety belt system would not necessarily be optimized for kinematic performance, belt comfort, restraint system integrity, and the like. Because of these concerns, Ford indicated that it was moving the anchorages for rear outboard seats in most of its car lines to optimally accommodate factory-installed integral lap/shoulder belts.

Ford also indicated that it was simply not possible for it to complete the necessary testing and design modifications and incorporate those changes into production for the current design of the line in question within the period proposed in the NPRM (i.e., by September 1, 1989). Ford asserted that it would need at least 42 weeks of leadtime to begin production of cars in this line with integral lap/shoulder belts in the rear. Additionally, Ford stated that the successor vehicle for this line would have integral lap/shoulder belts at the rear outboard seating positions. Thus, instead of making the investment in design, testing, and production changes for a car line that will not be produced after April 1990, Ford indicated that it might stop production of that line eight months earlier than is now planned.

When NHTSA issued the NPRM, the agency believed that Ford would voluntarily install rear-seat lap/shoulder belts on all of its 1990 car lines. Since that is not the case, and since Ford faces special difficulties in bringing one of its car lines into compliance, the agency must revise its tentative conclusion that a September 1, 1989, effective date was practicable for a requirement for *integral* rear-seat lap/shoulder belts. This final rule reflects a balancing of the need to ensure that any new requirements in the safety standards are "practicable" (as required by the Safety Act) with the public safety benefits from the earliest practicable effective date for these requirements. The agency is therefore adopting a schedule of effective dates that addresses both these needs, as described below.

Subaru's objection to the proposed requirement was based on the fact that one of its models (the Loyale station wagon) is already voluntarily equipped with rear-seat lap/shoulder belts, but the anchorage for the upper end of the shoulder belt is outside the anchorage location zones specified in Standard No. 210. Some background information on this situation may be helpful.

Subaru previously sought an interpretation from NHTSA as to whether the company would be permitted to use an anchorage location outside of the zones specified in Standard No. 210 for the upper anchorage of voluntarily installed rear-seat lap/shoulder belts. In an October 13, 1988, interpretation letter to Mr. Paul Utans of Subaru, NHTSA responded that components voluntarily installed in addition to required safety systems are not themselves required to comply with the safety standards, provided that the additional components do not diminish the ability of the required systems to comply with the safety standards. In this case, the shoulder belts were voluntarily installed by Subaru, so the shoulder-belt portions of the lap/shoulder belt systems were not required to comply with the anchorage location requirements in Standard No. 210 or any other of the requirements in the safety standards. Instead, the only limitation on the voluntarily installed shoulder belts was that they could not diminish the ability of the required lap belts to comply with the safety standards. This letter concluded by noting that this interpretation would no longer apply if NHTSA adopted a final rule requiring rear-seat lap/shoulder belts in passenger cars, because the interpretation was based upon the voluntary nature of the shoulder belt installation.

Because of this interpretation, Subaru correctly assumed in its comments that the upper anchorages for the rear-seat lap/shoulder belts in its Loyale station wagons would have to comply with all requirements of Standard No. 210, including the location requirements, if the proposed rule were adopted as a final rule and became effective. This would obligate Subaru to redesign the rear-seat lap/shoulder belt system in its Loyale station wagon, conduct testing of the redesign, and incorporate the redesign into production. In comments similar to those of Ford, Subaru asserted that the proposed leadtime until September 1989 was too short, but that vehicles manufactured after September 1990 could comply with the proposed requirements.

When NHTSA proposed that this rule become effective nine months after the NPRM was published, the agency recognized that this amount of leadtime was substantially less than is frequently proposed for other significant rulemakings. This foreshortened leadtime reflected NHTSA's belief that manufacturers would not need to make engineering or design changes to install lap/shoulder belts in the rear outboard seating positions of passenger cars other than convertibles, especially in view of the substantial commitments for voluntary installation of such belts. *See* the discussion under the heading, *9. Proposed Timing for Applying These Requirements to Vehicle Types*, in the preamble to the NPRM (53 FR 47991). The Ford and Subaru comments show instances where the agency's tentative conclusions about the sufficiency of the leadtime were inaccurate, because those manufacturers would need to make engineering and design changes to comply with the proposed requirements.

After reviewing the comments, NHTSA does not believe that a final rule would be "practicable" if it were effective in September 1989 and adopted all of the NPRM's proposed requirements for integral rear-seat lap/shoulder belts using anchorages that comply with Standard No. 210. However, a final rule adopting a general requirement for rear-seat lap/shoulder belts effective six months after publication of this final rule would be practicable, if the requirements did not require integral belts or complying anchorages. This general requirement would ensure all cars had lap/shoulder belts installed as original equipment in the rear seat. Some production changes might still be needed, since Ford had not planned to install the shoulder belt retrofit kits as original equipment in the single line discussed above. However, these production changes would be practicable 180 days after publication of this rule.

Accordingly, NHTSA has decided to adopt a general requirement that passenger cars other than convertibles be equipped with rear-seat lap/shoulder belts, beginning 180 days after this rule is published. This general requirement specifically excludes these rear-seat safety belts from the existing requirements that lap/shoulder belts be integral and that anchorages comply with all requirements of Standard No. 210. These exclusions will expire August 31, 1990. Hence, all passenger cars other than convertibles manufactured on or after September 1, 1990, must have *integral* rear-seat lap/shoulder belts and use shoulder belt anchorages that comply with all requirements of Standard No. 210.

As noted above, the second step of the agency's final action in this rulemaking will address all of the detailed proposals set forth in the NPRM for all the vehicle types. The issue of the retractor type that should be required for passenger car rear-seat lap/shoulder belts, and its compatibility with child restraint systems, will be addressed during that second step, not in this rule. This rule leaves the existing provisions of S7.1.1 of Standard No. 208 in place. Those provisions require that the lap belt adjust by means of *either* an automatic locking retractor (ALR) or an emergency locking retractor

(ELR), and the shoulder belt adjust by means of *either* an ELR or a manual adjusting device. That second rule will also address vehicles other than passenger cars, as well as the definition of an "outboard seat," details of the comfort and convenience requirements, special requirements for tension-relieving devices on these belts, and the other issues raised in comments on the NPRM.

In consideration of the foregoing, 49 CFR Part 571 is amended as follows:

S4.1.4 is revised to read as follows:

S4.1.4 *Passenger cars manufactured on or after September 1, 1989.*

S4.1.4.1 Except as provided in S4.1.5 and S4.1.4.2, each passenger car manufactured on or after September 1, 1989, shall comply with the requirements of S4.1.2.1. Until September 1, 1993, each car whose driver's designated seating position complies with the requirements of S4.1.2.1(a) by means not including any type of seat belt and whose right front designated seating position is equipped with a manual Type 2 seat belt that meets the requirements of S5.1, with the Type 2 seat belt assembly adjusted in accordance with S7.4.2, shall be counted as a vehicle complying with S4.1.2.1. A vehicle shall not be deemed to be in noncompliance with this standard if its manufacturer establishes that it did not have reason to know in the exercise of due care that such vehicle is not in conformity with the requirement of this standard.

S4.1.4.2 (a) Each passenger car, other than a convertible, manufactured on or after December 11, 1989 and before September 1, 1990, shall be equipped with a Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR § 571.209) and with S7.1.1 of this standard.

(b) Each passenger car, other than a convertible, manufactured on or after September 1, 1990, shall be equipped with an integral Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR § 571.209) and with S7.1.1 and S7.2 of this standard.

* * * * *

§ 571.210 [Amended]

The introductory text of S4.3 of Standard No. 210 is revised to read as follows:

S4.3 *Location.* As used in this section, "forward" means the direction in which the seat faces, and other directional references are to be interpreted accordingly. Anchorages for automatic seat belt assemblies and for dynamically tested seat belt assemblies that meet the frontal crash protection requirements of S5.1 of Standard No. 208 (49 CFR § 571.208) are exempt from the location requirements of this section. Anchorages are exempt from the requirements of S4.3.2 of this standard, if those anchorages are for the upper torso portion of a Type 2 seat belt assembly installed at a forward-facing rear outboard seating position of a passenger car, other than a convertible, that is manufactured on or after December 11, 1989 and before September 1, 1990.

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Issued on June 9, 1989

Jeffrey R. Miller
Acting Administrator

54 F.R. 25275
June 14, 1989

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

School Bus Passenger Seating and Crash Protection
(Docket No. 87-08; Notice 5)
RIN: 2127-AD12

ACTION: Final rule.

SUMMARY: This rule establishes a new requirement for lap/shoulder safety belts to be installed in all forward-facing rear outboard seating positions in convertible passenger cars, light trucks and multipurpose passenger vehicles (e.g., passenger vans and utility vehicles), and small buses. Rear-seat lap/shoulder belts are estimated to be even more effective than rear-seat lap-only belts in reducing fatalities and moderate-to-severe injuries. As safety belt use in the rear seat of these vehicle types increases, the greater effectiveness of rear-seat lap/shoulder belts should yield progressively greater safety benefits. NHTSA also anticipates that this rule will achieve benefits by helping to increase safety belt use in rear seating positions of these vehicle types, by providing rear-seat occupants with maximum safety protection when they buckle up.

This rule also establishes a requirement for lap/shoulder belts to be installed at the driver's seat and at any other front outboard seating position in small buses. NHTSA believes that lap/shoulder safety belts in these small buses will offer the same benefits as lap/shoulder belts in those positions offer to occupants of passenger cars, light trucks, and light multipurpose passenger vehicles.

EFFECTIVE DATE: The amendments of S7.1.1.3 and S7.1.1.5 are effective on September 1, 1991. All the other amendments made by this rule take effect on May 1, 1990. These requirements apply to convertible passenger cars, light trucks, light multipurpose passenger vehicles, and small buses manufactured on or after September 1, 1991. Convertible passenger cars, light trucks, light multipurpose passenger vehicles, and small buses manufactured before September 1, 1991 may also comply with these requirements.

SUPPLEMENTARY INFORMATION: ***Background.*** On January 1, 1968, the initial Federal Motor Vehicle Safety Standards took effect. One of those standards was Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208), which required the installation of lap/shoulder safety belts at the driver's and right front passenger's seating positions of passenger cars, and either lap-only or lap/shoulder safety belts at every other designated seating position. Another of the initial safety standards that took effect on January 1, 1968 was Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR 571.210), which specified location and strength requirements for the anchorages used to hold the safety belts to the passenger car during a crash. Standard No. 210 required passenger car manufacturers to provide anchorages for lap/shoulder belts for each forward-facing front *and* rear outboard seating position in all cars other than convertibles. NHTSA subsequently amended both of these standards to extend their applicability to trucks, multipurpose passenger vehicles (MPVs), and buses. However, when Standard No. 210 was extended to these additional vehicle types, NHTSA did not require the manufacturers to provide upper torso (i.e., shoulder belt) anchorages for rear outboard seating positions in these other vehicle types or in convertible passenger cars.

Studies of occupant protection from 1968 forward show that the lap-only safety belts installed in rear seating positions are effective in reducing the risk of death and injury. See, for example, the studies cited in the ANPRM on this subject; 52 FR 22820, June 16, 1987. However, the agency believes that rear-seat lap/shoulder safety belts would be even more effective. NHTSA estimates that rear-seat lap-only belts reduce the risk of death by 24-40 percent, while rear-seat lap/shoulder belts reduce that risk by 32-50 percent. The somewhat greater effectiveness of lap/shoulder belts vs. lap-only belts in the rear seat results in progressively greater actual safety benefits for rear-seat occupants, to the extent that those safety belts are, in fact, used. As recently as 1981-82, only two percent of rear-seat occupants used their safety belts. At that level of belt use, there are very few safety benefits from requiring rear-seat lap/shoulder belts instead of lap-only belts. However, belt use in the rear seat has steadily risen, with 16 percent of rear seat occupants buckling up in 1987. As rear-seat belt use continues to rise, the incremental benefits of rear-seat lap/shoulder belts can be realized.

The increase in belt use in rear seats was one of the factors reflected in the agency's decision to grant a petition by the Los Angeles Area Child Passenger Safety Association asking NHTSA to establish a requirement for rear-seat lap/shoulder safety belts. After granting this petition, NHTSA published an advance notice of proposed rulemaking (ANPRM) on June 16, 1987 (52 FR 22818). Thirty-four commenters responded to the ANPRM's request for comments on the need for rulemaking action to require lap/shoulder safety belts in rear seating positions.

After considering these comments, NHTSA concluded that several factors had changed since the agency had previously examined this issue and determined that it was appropriate to give vehicle manufacturers the option of installing either lap-only belts or lap/shoulder belts in rear seats. Among the changed factors were the substantial increase in rear seat safety belt use and the substantial decrease in costs of a requirement for rear-seat lap/shoulder belts, because of manufacturers voluntarily equipping more and more of their vehicles with rear seat lap/shoulder belts. After analyzing the effects of these changed factors and the comments on the ANPRM, NHTSA tentatively determined that a requirement for lap/shoulder belts would now be appropriate. Accordingly, NHTSA published a notice of proposed rulemaking (NPRM) on November 29, 1988 (53 FR 47982).

This NPRM was a comprehensive proposal that proposed requirements for passenger cars and light trucks, MPVs, and small buses to be equipped with lap/shoulder safety belts at all forward-facing rear outboard seating positions. Additionally, the NPRM proposed that these lap/shoulder safety belts be equipped with a particular type of retractor, that such belts be integral (i.e., the shoulder belt could not be detachable from the lap belt), and that such belts comply with some of the comfort and convenience requirements specified in section S7.4 of Standard No. 208.

More than 70 comments were received on this NPRM. The issue of whether passenger cars other than convertibles would be equipped with rear seat lap/shoulder belts was straightforward and noncontroversial, with only two commenters suggesting some modifications of the agency's proposal to require all 1990 and subsequent model year passenger cars to be equipped with rear-seat lap/shoulder belts. To ensure the earliest possible implementation of a requirement for rear-seat lap/shoulder belts in passenger cars, on June 14, 1989, NHTSA published a final rule addressing only those vehicles (54 FR 25275). That rule requires rear-seat lap/shoulder belts in all passenger cars manufactured on or after December 11, 1989.

This rule addresses all of the other issues that were presented in the November, 1988 NPRM on this topic. For the convenience of the reader, this rule uses the same organization and format as the NPRM did.

Requirements of this Rule

1. Seating Positions Subject to These Requirements

The NPRM proposed that lap/shoulder belts be required in rear seats at outboard seating positions *only*. Some commenters suggested that technologies and designs are available to provide lap/shoulder belts at rear center seating positions, and that NHTSA should further examine this issue. The agency explained in the NPRM that there are more technical difficulties associated with any requirement for lap/shoulder belts at center rear seating positions, and that lap/shoulder belts at center rear seating positions would yield small safety benefits and substantially greater costs, given the lower center seat occupancy rate and the more difficult engineering task. Accordingly, this rulemaking excluded further consideration of a requirement for center rear seating positions. None of the commenters presented any new data that would cause the agency to change its tentative conclusion on this subject that was announced in the NPRM.

The NPRM also noted that seating positions adjacent to aisleways in some vans might not be "outboard designated seating positions" as defined at 49 CFR § 571.3, because those aisle seats could be more than 12 inches from the inside of the vehicle. General Motors (GM) stated its belief that this discussion showed the agency's intent to exclude seats that border aisleways from the lap/shoulder belt requirement. GM suggested that the reasons for excluding these seating positions from the lap/shoulder belt requirement were the costs and/or practical difficulties that would be presented if aisleway seating positions were required to be equipped with lap/shoulder belts. Specifically, GM stated that locating the anchorage for the upper end of the shoulder belt on the aisle side of the vehicle would stretch the shoulder belt across the aisleway and cause entry and exit problems for occupants of seating positions to the rear of the aisleway seating position. To avoid such difficulties, the anchorage for the upper end of the shoulder belt could be moved to the roof of the vehicle. However, roof structural modifications would have to be made to accommodate the anchorage, and these modifications would impose disproportionately high costs. GM stated in its comments that these reasons would apply with equal force to all seats adjacent to aisleways, regardless of whether such seats were more than or less than 12 inches from the inside of the vehicle.

NHTSA has determined that these comments have merit. The agency did not mean to suggest that shoulder belts should be required at seating positions where they would obstruct an aisle designed to give access to rear seating positions. Accordingly, this rule has been modified from the proposal to specify that these rear-seat lap/shoulder belt requirements apply

to rear outboard seating positions *except* any outboard seating positions that are adjacent to a walkway located between the seat and the side of the vehicle to allow access to more rearward seating positions. Of course, in those cases where manufacturers are able to design and install lap/shoulder belts at seating positions adjacent to aisleways without interfering with the aisleway's purpose of allowing access to more rearward seating positions, NHTSA encourages the manufacturers to do so. It should also be noted that those rear seating positions at which lap/shoulder belts are not installed voluntarily or in response to a regulatory requirement *are required* by Standard No. 208 to be equipped with lap-only safety belts, which have been proven effective in reducing the risk of death and injury.

2. Types of Rear Seats Subject to These Requirements

The NPRM proposed limiting these requirements to *forward-facing* rear outboard seats, because the agency is unaware of any data showing that occupants of center-facing or rear-facing seating positions would be significantly better protected by lap/shoulder belts than by lap-only belts. The NPRM also referred to an April 8, 1988 letter to Mr. Ohdaira of Isuzu Motors, in which NHTSA stated that S7.1.1 of Standard No. 208 requires safety belts on swivel seats installed at *front* outboard seating positions to adjust to fit occupants "with the seat in any position." Because the same regulatory language would apply to swivel seats installed at *rear* outboard seating positions if the proposal were adopted as a final rule, the NPRM proposed to add express regulatory language to S7.1.1 to codify the interpretation.

Three commenters responded to this discussion in the NPRM. Ford, Nissan, and Toyota raised substantially the same points in their comments. These commenters all suggested that the agency ought to require swivel seats to provide lap/shoulder belts for occupants when the seats are forward-facing, but permit occupants to be restrained by lap-only belts when the swivel seats are adjusted to some position other than forward-facing. These manufacturers argued that the overall protection of upper torso restraints (i.e., shoulder belts) on occupants of center-facing seating positions is unclear. For example, in certain instances, the design standard in Australia *prohibits* manufacturers from providing upper torso restraints at center-facing seating positions. Further, these manufacturers stated that they knew of no crash data suggesting the need for such a requirement. According to these commenters, the absence of demonstrable safety benefits associated with such a requirement combined with the demonstrable technological problems and costs associated with such a requirement should lead the agency to require only lap belts when swivel seats are adjusted to a position other than forward-facing.

NHTSA was persuaded by these comments. Indeed, as Ford noted in its comments, just as the NPRM stated that no data show that occupants of center-facing or rear-facing seats would be significantly better protected by lap/shoulder belts instead of lap-only belts, no data show that occupants of swivel seats adjusted to the center-facing or rear-facing positions would be significantly better protected by lap/shoulder belts instead of lap-only belts. Accordingly, this final rule adds language to Standard No. 208 that requires swivel seats to provide lap/shoulder belts for occupants when the seat is adjusted to the forward-facing position and permits swivel seats to provide lap-only belts for occupants when the seat is adjusted to some position other than forward-facing. The Ohdaira interpretation is, therefore, overruled to the extent that it is inconsistent with this new language in Standard No. 208.

In its comments, Ford indicated that it would be appropriate for this preamble to discuss a type of seat Ford is considering installing in future vehicle models. This seat was described as a bench seat that converts from forward-facing to rear-facing. Under the language added to Standard No. 208 by this rule, all seats that can be adjusted to a forward-facing position and some other position, regardless of whether such seats are swivel seats, convertible seats of the sort described in Ford's comment, or any other such seat, must provide lap/shoulder belts when in the forward-facing position and may provide lap-only belts when adjusted to some position other than forward-facing.

3. Vehicle Types Subject to These Requirements

a. Passenger Cars

In the NPRM, the agency proposed to make the requirement for rear seat lap/shoulder belts apply to *all* passenger cars, including convertibles. As previously discussed, the requirements for passenger cars other than convertibles were published in a June 14, 1989 final rule (54 FR 25275). The NPRM proposed that rear seat lap/shoulder belts be required on convertible passenger cars manufactured on or after September 1, 1991.

In its comments, Volkswagen asked for an additional year of leadtime, until September 1, 1992, before rear seat lap/shoulder belts must be installed in convertible passenger cars. According to this commenter, the convertible version of its Golf model (the Cabriolet) is not currently equipped with rear seat lap/shoulder belts, was not originally designed to accommodate such belts, and will need substantial modifications to its current design if the car is to accommodate such belts.

No change has been made in response to this comment. The NPRM noted that it was more difficult to install rear seat lap/shoulder belts in convertibles than in other passenger cars, but that, in spite of these difficulties, at least three different manufacturers had rear-seat lap/shoulder belts in their 1988 model year convertibles. Accordingly, the agency proposed to require convertible passenger cars to be equipped with rear-seat lap/shoulder belts, but to allow two years more leadtime than was proposed for other passenger cars, in recognition of the greater technical difficulties. Volkswagen's comment appears to be that more than two years of additional leadtime is needed to overcome the greater technical difficulties associated with convertibles, although the comment does not include any explanation or analysis of why this is so. A manufacturer's unsubstantiated desire for additional leadtime is not a sufficient basis for the agency to postpone the proposed September 1, 1991 effective date for rear seat lap/shoulder belts in convertibles. Therefore, this rule adopts the proposed requirement.

b. Light Multipurpose Passenger Vehicles.

This vehicle type consists primarily of passenger vans with a seating capacity of 10 persons or less and utility vehicles and other off-road vehicles. None of the commenters suggested any particular problems that a requirement for rear-seat lap/shoulder belts would impose on MPVs in general. Toyota repeated its position that the voluntary installation of rear-seat lap/shoulder belts by manufacturers in all vehicle types made it unnecessary for NHTSA to proceed with this rulemaking. NHTSA responded at length to similar comments by the vehicle manufacturers in the preamble to the NPRM; *see* 53 FR 47984.

Ford did not object to the proposed general requirement for rear-seat lap/shoulder belts in light MPVs, but asked that open-body type MPVs be excluded from the requirement. Ford explained its comment by stating that its Bronco II utility vehicle has a removable roof over the rear passenger and cargo area. According to Ford's comments, "Because the removable roof on this vehicle extends below the shoulder reference point, it would be impossible to obtain a good shoulder belt fit if the shoulder belt anchorages were to be located on the non-removable side panels of the vehicle." For these reasons, Ford suggested that open-body type MPVs be exempted from these requirements or that the proposed requirements be revised to make clear that rear-seat lap/shoulder belts are not required in open-body type MPVs when the roof is removed.

NHTSA agrees with Ford's assertions that open-body type MPVs present greater technical difficulties for the installation of rear seat lap/shoulder belts than other MPVs or convertible passenger cars. For example, the rear seats are closer to the rear of the vehicle and the rear seats are higher in relation to the vehicle floor and sides in most open-body type MPVs than in most convertible passenger cars. The agency concurs with Ford's assertion that these factors tend to make the shoulder belt geometry more difficult in open-body type MPVs. However, the agency does not believe that these factors present insurmountable engineering difficulties. Instead, NHTSA believes that these problems can be solved in a relatively straightforward manner. While manufacturers cannot use the exact same designs used for convertible passenger cars on open-body type MPVs, the convertible passenger car designs can be modified for use in open-body type MPVs. NHTSA concludes that if it is practicable to offer the increased protection of shoulder belts at rear outboard seating positions, and the added costs are comparable to the costs for other MPVs and convertible passenger cars, there is no reason to exclude open-body type MPVs from the requirement for rear seat lap/shoulder belts in MPVs. Hence, no change has been made to the proposed requirements for MPVs in response to this comment by Ford.

The agency notes that this means that lap/shoulder belts will be required in the rear outboard seats of open-body type MPVs, while lap-only belts will be permitted in front outboard seats of those vehicles. (In practice, however, manufacturers have voluntarily provided front-seat lap/shoulder belts in these vehicles.) NHTSA is in the process of re-examining the occupant protection requirements for the front seating positions in open-body type MPVs and other light trucks and vans, with particular consideration of whether automatic occupant protection should be required in these vehicles. NHSTA will address the discrepancy between the regulatory requirements for front and rear seat occupant protection in open-body type MPVs in the course of that re-examination.

c. Light Trucks and Small Buses

All commenters that addressed the proposed requirements for rear-seat lap/shoulder belts in light trucks supported the proposal. Similarly, no commenters raised any objections to the proposed rear-seat lap/shoulder belt requirements in small buses *other than school buses*. Thus, those proposed requirements are adopted, for the reasons explained in the NPRM.

However, several commenters, primarily school bus manufacturers and operators, objected to the proposed requirements for rear-seat lap/shoulder belts in small school buses. Thomas Built, a school bus manufacturer, questioned the effectiveness of rear-seat lap/shoulder belts in certain small school buses ("body on chassis" buses). The Connecticut Operators of School Trans-

portation Association (COSTA) also questioned the effectiveness of lap/shoulder belts in small school buses, by voicing concerns about how the additional stress on the side walls of a small school bus would affect its compliance with Standard No. 221, *School Bus Body Joint Strength* (49 CPR 571.221). Thomas Built also raised the issue of different levels of safety protection for passengers on small school buses, with lap/shoulder belts for outboard seating positions and lap-only belts for the the inboard seating positions. The National School Transportation Association (NSTA) likewise objected to the different levels of occupant protection that would result if some seating positions were equipped with lap/shoulder belts while others were equipped with lap-only belts. Blue Bird, another school bus manufacturer, raised similar objections, claiming that NHTSA occupant protection standards for school buses are "disorganized and confusing," and suggested that the agency undertake rulemaking to separate the occupant protection requirements for school buses from the occupant protection standards for passenger cars and light trucks. Additionally, Blue Bird argued that the requirements proposed in the NPRM would require too many varieties of occupant protection for small school buses.

NHTSA is concerned if Blue Bird or any other school bus manufacturer is having difficulty understanding the occupant protection requirements applicable to the different types of vehicles that can be used to transport school children. A brief summary of those requirements might be helpful. If school systems use a nine or fewer passenger vehicle to transport school children, that vehicle is not a "school bus" for the purposes of the Federal motor vehicle safety standards. Accordingly, that vehicle is not subject to any of the requirements in Standard No. 222, *School Bus Passenger Seating and Crash Protection* (49 CFR § 571.222). Instead, that vehicle would have to comply with the applicable requirements in Standard No. 208. As a result of this rule published today and the agency's previous rulemaking, all front and rear outboard seating positions in nine-passenger light vehicles must be equipped with lap/shoulder safety belts, *irrespective* of whether the nine-passenger light vehicle is classified as a passenger car, truck, or an MPV.

If the vehicle used to transport school children can accommodate 10 or more passengers, the vehicle is a "school bus" for the purposes of the Federal motor vehicle safety standards. Every vehicle that is a "school bus" must comply with the occupant protection requirements of Standard No. 222. In the case of school buses with a gross vehicle weight rating (GVWR) of more than 10,000 pounds, no safety belts are required at seating positions other than the driver's seat. Instead, Standard No. 222 sets forth requirements that protect occupants of rear seating positions in large school buses by means of a concept called "compartmentalization." Persons interested in learning more about the concept of compartmentalization and occupant protection in large school buses may wish to review the agency's notice terminating rulemaking to specify installation requirements for voluntarily installed safety belts on large school buses. This notice was published March 22, 1989 at 54 FR 11765.

In the case of school buses with a GVWR of 10,000 pounds or less, Standard No. 222 requires that occupants be protected *both* by safety belts at seating positions other than the driver's seat *and* by most of the features of compartmentalization. This double means of occupant protection reflects the more severe "crash pulse" or deceleration experienced by lighter vehicles as compared with heavier vehicles in similar collisions. Sections S5(b) of Standard No. 222 requires that small school buses meet the requirements of Standard No. 208 as those requirements apply to MPVs. The provisions of Standard No. 208 currently require MPVs (and small school buses, since the requirements for these two vehicle types are linked) to be equipped with lap/shoulder safety belts at front outboard seats and either lap/shoulder belts or lap-only belts at all other seating positions.

Upon further consideration, NHTSA has determined that the occupant protection requirements for small school buses should be considered separately, not as an aspect of the rulemaking action. In the past, NHTSA has recognized the special importance of issues related to school buses by examining many of those issues in rulemaking actions focused exclusively on school buses, instead of examining those issues as one part of a rulemaking addressing many types of vehicles. This policy has allowed both the agency and the public to consider fully the implications of any proposed action on school buses safety. NHTSA believes it is appropriate to continue following this policy. Accordingly, this rule continues to permit small school buses to be equipped with either lap-only or lap/shoulder safety belts at all rear seating positions, but small school buses must also comply with most of the compartmentalization requirements for large school buses. All other small buses will be required to be equipped with rear-seat lap/shoulder safety belts, but will not be required to comply with the compartmentalization requirements.

The NPRM acknowledged that small buses other than school buses are not currently required to have lap/shoulder safety belts at front outboard seating positions, even though front seats generally present a more hostile crash environment than rear seats. As noted above, small school buses are subject to the occupant protection requirements for MPVs, and small MPVs have long been required to have lap/shoulder safety belts at front outboard seating positions. No

commenters suggested any reasons why front-seat lap/shoulder belts should not be required in small buses, just as they are required in small school buses. This rule adopts such a requirement.

4. Vehicle Types NOT Subject to These Requirements

a. Vehicles with a GVWR of More Than 10,000 Pounds

NHTSA has traditionally used GVWRs as dividing lines for the purposes of applying occupant crash protection standards. These groupings reflect the differences in the vehicles' functions and crash responses and exposure. The NPRM proposed to use such a dividing line by limiting the rear seat lap/shoulder belt requirements to vehicles with a GVWR of 10,000 pounds or less. No commenters addressed this issue, and this rule adopts the proposal.

b. Motor Homes

The NPRM proposed to exclude vehicles that are "motor homes" from the rear-seat lap/shoulder belt requirements, because lap/shoulder belts at rear seating positions might interfere with the residential purposes of those seats and because the agency had no evidence of significant potential benefits from lap/shoulder belts, instead of the currently permitted option for lap/shoulder or lap-only belts, at these seating positions. The NPRM also proposed a specific definition of "motor home." These proposed requirements are adopted in this rule.

5. Retractor Types Required for Rear Seat Lap/Shoulder Belts

Retractors at Driver's Seat in Small Buses.

The NPRM proposed to require that the lap/shoulder belt assembly installed at the driver's seating position of small buses include an anti-cinch automatic locking retractor (ALR) on the lap belt portion. Both Ford and Chrysler objected to this proposed requirement, stating that it would preclude the use of the continuous loop lap/shoulder belt system in small buses. The continuous loop system, currently used on most manual lap/shoulder belt systems in passenger cars, uses a single emergency locking retractor (ELR) on one end of the belt system and the other end of the belt system is fixed. The ELR then retracts both the lap and shoulder belt portions of the belt system. Ford and Chrysler each commented that they currently use a continuous loop system for the lap/shoulder belts that they voluntarily install at the front outboard seating positions of their small buses, and that they knew of no safety justification for a requirement that would prohibit the use of continuous loop system in small buses, as the proposed requirement for an ALR for the lap belt would have the effect of doing. NHTSA was persuaded by these comments. This rule has been amended to permit the belt systems at front outboard seating positions in small buses to be equipped with either an ELR or an anti-cinch ALR for the lap belt portion.

Retractors for Rear Seats and Child Safety Seats

The NPRM contained a detailed discussion of the agency's previous statements on this subject, and repeated the agency's previous conclusion that *only* ELRs should be permitted as the retractor for the lap belt portion of the lap/shoulder belt system. See 53 FR 47987-47989; November 29, 1988. The agency's conclusion was based on the fact that ELRs for the lap belt made the belt system more comfortable and convenient for adult occupants, thereby tending to increase use of the belt system. Although active children can make some child restraint systems unstable if the child restraint is secured by a lap belt that incorporates an ELR, NHTSA knew of no data to show that this potential instability would affect the safety performance of the child restraint in motor vehicle crashes. Those parents that wanted to eliminate the potential instability of child restraints, even if the instability did not have any demonstrable effect on safety, could purchase locking clips. These locking clips can prevent movement of belts equipped with an ELR.

NHTSA received many comments on this discussion and the accompanying proposal. Many pediatricians and other medical professionals, as well as advocates of child safety, associations representing the insurance industry, and manufacturers of child safety seats, commented that it was important that the belt system in the vehicle be capable of tightly securing a child seat, without resort to any additional hardware like locking clips. The commenters suggested differing means of achieving this end. Some of these commenters advocated that this rule should specify the use of only ALRs in the lap belt portion, because ALRs automatically tighten down to secure the child seat. Other of these commenters, such as the Los Angeles Area Child Passenger Safety Association, urged the agency to draft this rule to require the use of convertible retractors similar to those installed in some General Motors vehicles. These convertible retractors function as ELRs normally, to ensure comfort for adult occupants. When the belt webbing is fully extended, however, the retractors convert to ALRs, to tightly secure child seats. Other of these commenters suggested that the agency could ensure that these rear-seat lap/shoulder belt systems would tightly secure child seats by following the course of action being considered for recommendation by a Society of Automotive Engineers (SAE) Task Force. That task force may recommend that safety belts which incorporate ELRs in the lap belt or lap belt portion of a belt assembly shall include a means for locking the lap belt when it is used with a child seat. Instead of specifying

the use of some specific technology, like ALRs or convertible retractors, this approach sets forth the desired goal and permits manufacturers to use any available technology to achieve that goal.

Some of the vehicle manufacturers, such as Nissan and Toyota, believe that there is no need for any further requirements. According to these commenters, and persons wishing to secure a child seat at a seating position whose lap belt is equipped with ELR can cause the retractor to perform like an ALR simply by using a locking clip. Volvo commented that the agency ought to permit the use of a continuous loop lap/shoulder belt. Volvo asserted that its design of the continuous loop system uses friction at the loop in the buckle to achieve an effect similar to that which would be obtained by using a locking clip. In Volvo's opinion, this lap/shoulder belt system is the best means of both securing child safety seats and ensuring comfort for other occupants of the belt system. Chrysler commented that it was considering modifications to the buckle latchplate as a means of accomplishing the same effect as would locking clips for its belt assemblies equipped with ELRs.

NHTSA has reached the following conclusions after reexamining the available information in light of these comments. Nothing in these comments or the available information shows that low-speed movement of child safety seats actually reduces to any significant extent the effectiveness of those seats in crashes. However, the low-speed movement of child safety seats held by lap belts that use an ELR seems to have given rise to questions and concerns about the safety and effectiveness of child seats when used with a belt that incorporates an ELR. Even if these questions and concerns have not been substantiated, the public may not be as likely to use child safety seats if there are perceived questions about the effectiveness of those seats. NHTSA has concluded that it is appropriate to take action to remove these perceived questions, so as to maintain public trust and confidence in the efficacy of child seats.

The agency was persuaded by the comments asserting that it would be unnecessarily restrictive to require the use of ALRs on the lap belt portion of rear seat lap/shoulder belts, because there are design features other than incorporating an ALR that are as effective in ensuring that the belt system can tightly secure a child safety seat and because such a feature could reduce safety belt use by adult occupants. NHTSA has devised an approach in this final rule that will ensure comfort for adult occupants and tight securing of child safety seats. First, this rule requires that any lap belt or lap belt portion of a lap/shoulder belt installed at an outboard designated seating position in compliance with Standard No. 208 shall be equipped with an ELR. This requirement will take effect on September 1, 1991 for passenger cars, as well as the vehicle types addressed in this rule.

Second, this final rule requires that safety belts that incorporate an ELR in the lap belt or lap belt portion of a lap/shoulder belt shall provide some means other than an external device that requires manual attachment or activation that will prevent any further webbing from spooling out until that means is released or deactivated. This requirement will also take effect on September 1, 1991 for passenger cars and vehicle types addressed in this rule. The purpose of this requirement is to ensure that child safety seats can be tightly secured. This requirement will *not* allow vehicle manufacturers to provide "locking clops" to comply with this requirement. However, any means that can function without additional manual actions can satisfy this requirement. For instance, the convertible retractors on some GM vehicles would comply with this requirement. Additionally, devises like Volvo's are acceptable if those devices do not require any further manual actions to prevent webbing spool out. This approach is intended to allow vehicle manufacturers the freedom to choose whatever approach they prefer to prevent webbing spool out for ELRs, while ensuring that whatever approach is chosen will be effective.

6. The Requirements With Which Rear Seat Lap/Shoulder Belts Must Comply

The NPRM did not propose to require any crash testing requirements for rear-seat lap/shoulder belts, for several reasons. First, neither dummy positioning procedures nor testing procedures for rear seat occupants have yet been developed. In fact, the rear seats are generally removed from vehicles when conducting compliance testing for occupant protection for the front seating positions, to allow the specified weight distribution to be more easily achieved and to permit the installation of additional instrumentation. Second, the rear seating positions offer a generally more benign crash environment than the front seating positions. Accordingly, the agency concluded that it could not justify delaying a proposal for rear-seat lap/shoulder belts until it was able to propose a requirement for dynamic testing of those safety belts. Several commenters stated that they agreed with the agency's decision not to delay this rulemaking, but suggested that the agency ought to move expeditiously to establish crash testing requirements for rear seat occupants. NHTSA will consider these comments when it establishes its priorities for future activities in the area of occupant protection.

As an adjunct to the decision not to require crash testing of rear-seat lap/shoulder belts, the agency proposed to require that rear-seat lap/shoulder belts be

integral. Section S4.1.2.3.1 of Standard No. 208 specifies that manual safety belts installed at front outboard seating positions must be either (a) integral lap/shoulder belts or (b) crash-tested lap-only belts such that the car complies with the occupant protection requirements with test dummies restrained only by the lap belts. However, since the agency cannot at this time promulgate any crash testing requirements for rear-seat safety belts, NHTSA believes it is appropriate to require that rear-seat lap/shoulder belts installed in compliance with this rule be integral; i.e., the lap belt must not be detachable from the shoulder belt.

Several commenters suggested that the requirement for integral lap/shoulder belts should not apply to certain types of seats or vehicles, because of special difficulties posed for those seats or vehicles. In response to these comments, NHTSA has carefully reexamined it proposal to require that *all* rear seat lap/shoulder belts installed in compliance with this rule be integral. The agency prefers to retain the proposed requirement, for the same reasons that the requirement was proposed. That is, to the extent that the lap belt is detachable from the shoulder belt and the lap belt is used without the shoulder belt, the enhanced safety protection offered by lap/shoulder belts will not be achieved. The agency's responses to the comments suggesting that there are some seating positions or vehicles in which rear outboard lap/shoulder belts should not be required to be integral are as follows:

a. Convertible Passenger Cars. ASC, Inc., a company that converts hardtops into convertibles, commented that it did not believe that rear-seat lap/shoulder belts installed in convertibles should be required to be integral. According to ASC's comments, a detachable shoulder belt that is not buckled would still offer the occupant the protection of the lap-only belt. While this comment is true, the purpose of this rulemaking is to ensure that rear-seat occupants will enjoy even greater safety protection than is afforded by lap-only belts. Detachable shoulder belts would not serve this purpose.

ASC's comment then asserted that "the detachability feature is essential for ASC to continue to manufacture at a competitive price a majority of its present convertible production which is already equipped with three point lap-shoulder safety belts." Accordingly, ASC believed that a requirement for integral rear-seat lap/shoulder belts would have a "significant negative impact on its business." The agency has previously stated that it is typically more difficult to install rear-seat lap/shoulder belts in convertibles than in sedans or coupes. However, the 1988 convertible models produced by BMW, Mercedes-Benz, and Saab were all equipped with *integral* lap/shoulder belts at rear outboard seating positions. These voluntary actions by convertible manufacturers showed that the technical difficulties associated with integral rear seat lap/shoulder belts in convertibles can be overcome. It may well cost ASC, Inc. or other converters more to equip a convertible with integral rear-seat lap/shoulder belts than it would cost a high volume manufacturer. However, ASC provided no data or cost estimates that would permit the agency to estimate the cost differential for rear-seat lap/shoulder belts installed by high volume manufacturers and converters. Based on the available information, NHTSA concludes that it is unlikely that any such cost differential would have more than an insignificant effect on the demand for convertibles produced by converters.

NHTSA repeats it previous acknowledgements that it will cost manufacturers more to equip convertibles with integral rear seat lap/shoulder belts than it will cost to equip sedans and coupes with those safety belts. In its comments, Volkswagen stated that it would have to incur tooling costs of $1.2 million to install integral rear-seat lap/shoulder belts in its convertibles, with variable costs of an additional $60 per vehicle to install integral lap/shoulder belts instead of lap-only belts. NHTSA estimates that these costs would result in a consumer cost increase of $90 per vehicle. Even accepting these costs as accurate, NHTSA does not believe that a $90 cost increase for convertibles, which already cost substantially more than the hardtop version of the same vehicle, will have any *significant* negative impacts on the demand for convertibles, even those produced by converters.

To the extent that these costs result in some relatively minor economic impacts, the agency concludes that those costs and impacts are reasonable. The occupants of rear seating positions in convertibles are exposed to at least the same degree of risk of death and injury in a motor vehicle crash as occupants of rear seating positions in other light vehicles. In these circumstances, NHTSA has concluded it is appropriate to provide those occupants with the same amount of safety protection. Therefore, a requirement that convertible passenger cars manufactured on or after September 1, 1991 be equipped with integral lap/shoulder belts at rear outboard seating positions is adopted as proposed.

Fiat filed comments on behalf of Ferrari to the effect that it was possible to comply with the requirement for integral lap/shoulder belts for convertibles that were designed to include those safety belt systems. However, Fiat asserted that the steps needed to modify an existing convertible design to accept the upper anchorages for rear seat lap/shoulder belts "would be financially intolerable." Fiat asked that this final rule be structured to provide an exemption for at least two years for existing convertible designs "which cannot be made to comply without extreme economic and technical hardships." NHTSA has not done so. Section 123 of the Safety Act (15 U.S.C. 1410) and 49 CFR Part 555 set forth procedures for obtaining temporary exemptions from any of the generally applicable re-

quirements set forth in the safety standards. If Fiat is statutorily eligible for such an exemption and can make the requisite showings, it can obtain the temporary exemption it seeks in accordance with those statutory and regulatory requirements.

b. Readily Removable Seats. In the NPRM for this rule, the agency summarized Ford's comment to the ANPRM asserting that lap/shoulder belts installed for readily removable seats should be permitted to be nonintegral, since that would be more convenient for persons using the vehicle especially with the seats removed. NHTSA concurred with this assertion, but noted that permitting detachable shoulder belts would result in lower usage of the shoulder belts and lower safety benefits for this rule. The agency suggested that manufacturers are capable of designing an integral lap/shoulder belt system that is nearly as convenient as safety belt systems with nonintegral shoulder belts. The NPRM suggested: "For instance, a shoulder belt that is readily detachable at the anchorage could be used for the outboard seating positions." 53 FR 47990, November 29, 1988.

Both Ford and GM suggested in their comments that permitting belts to be detachable at the upper anchorage would ease the problems of providing integral lap/shoulder belts at outboard seating positions of readily removable seats. However, both these commenters also stated that a March 1, 1985 interpretation letter from NHTSA's Chief Counsel to Mr. Hiroshi Shimizu of Tokai Rika Co. appeared to state that the provisions of Standard No. 208 forbid the use of a lap/shoulder safety belt that is detachable at the upper anchorage.

Mr. Shimizu provided a diagram with his letter that illustrated the safety belt design in question. This diagram showed two reasons why this design would not comply with the requirements of Standard No. 208. First, because of the location of the retractor and the separate buckles for the lap and shoulder belt portions of this belt system, an occupant could release the shoulder belt buckle and use this system soley as a lap belt with no dangling shoulder belt webbing to alert the occupant to the need to fasten the shoulder belt buckle. Alternatively, an occupant could release the lap belt buckle and use the system solely as a shoulder belt with no dangling webbing to alert the occupant to the need to fasten the lap belt buckle. NHTSA stated that this design would not satisfy the requirement in S4.1.2.3.1 and S4.2.2 of Standard No. 208 the *non-detachable* shoulder belts be provided on some belt assemblies.

Second, section S7.2 of Standard No. 208 requires that the latch mechanism of seat belt assemblies shall release both lap and shoulder belt simultaneously and release at a single point by a pushbutton action. When both the lap and shoulder belt portions of Mr. Shimizu's design were buckled, the occupant would have to release both buckles to get out of the belt system. Hence, this belt system could not comply with Standard No. 208 because the release from the lap and shoulder belt would not be simultaneous, nor would it be at a single point.

NHTSA does not believe that the Shimizu interpretation forecloses all safety belt system designs that detach at the upper anchorage. The language of section S7.2 plainly requires that any such safety belt system must use a single, pushbutton buckle that releases the occupant from the lap belt and shoulder belt simultaneously. There is nothing inherent in the design of a safety belt system detachable at the upper anchorage that makes it impossible to comply with these requirements. Similarly, a shoulder belt could be detachable at the upper anchorage without incorporating an additional point at which the belt could be released by the seat occupant, such as the buckle in Mr. Shimizu's design. For example, manufacturers could install some type of spring operated "dog leash" device that would not be equipped with a push button release mechanism. By a "dog leash" device, NHTSA is referring to a device that does not use any form of push button release. Such devices rely on other actions such as a slide button or slide collar to mechanically uncouple the belt system from the upper anchorage. Such a design would not be prohibited by Standard No. 208 nor anything in the Shimizu interpretation. To make this more clear, this rule adopts language in Standard No. 208 expressly stating that vehicles with readily removable rear seats may use a shoulder belt that detaches at the upper anchorage point to meet the requirements for an integral rear-seat lap/shoulder belt.

c. Swivel seats. As previously noted, swivel seats and other seats that can be adjusted to be forward-facing and to face some other direction will be required to provide lap/shoulder belts only when in the forward-facing position and may provide lap-only belts when adjusted to face other directions. The agency had to consider the question of what requirements should be specified for the detachable shoulder belt. NHTSA could have required those belts to be detachable at the upper anchorage point, by establishing requirements such as were established for readily removable seats. However, that would have left the occupant of the swivel seat with webbing in his or her lap every time the occupant adjusted the seat to some position other than forward-facing. The shoulder belt webbing could become soiled, so that the occupant of the swivel seat not use either the lap belt alone or the belt as a lap/shoulder belt.

To prevent this, NHTSA has decided that seats that adjust to be forward-facing and to face in some other direction are the only rear outboard seating positions

that will *not* be required to be equipped with integral lap/shoulder belts. Instead, those seating positions may be equipped with a shoulder belt that is detachable at the latchplate.

However, this rule establishes an additional requirement that any such non-integral shoulder belt portion be equipped with an ELR, so that the shoulder belt portion will be available for use by all occupants of the seat in its retracted position, and will be less likely to become soiled. This will ensure that those occupants of adjustable seating positions that want the added protection of a lap/shoulder belt in these seating positions will have that protection.

The agency acknowledges that this requirement is likely to result in lower shoulder belt use at these seating positions than at other rear outboard seating positions. However, the agency concludes that belt use at these adjustable seating positions would be lower still if the agency were to require that the lap/shoulder belts be integral and the shoulder belt webbing were in the occupant's lap or on the floor of the vehicle. On balance, the agency concludes that the interests of occupants of adjustable rear seating positions will be best served by permitting the shoulder belt portion of the lap/shoulder belt system to be detachable at the buckle, i.e., non-integral, while including a requirement for a shoulder belt retractor so that a lap shoulder belt will always be available for those persons.

7. Comfort and Convenience

The NPRM stated that compliance with the provisions in S7.4.2(a), S7.4.3, S7.4.4, and S7.4.5 of Standard No. 208 is determined with reference to a test dummy for the front seating positions. As noted above, there are no dummy positioning procedures for the rear seating positions, so the agency cannot determine compliance with the comfort and convenience provisions with reference to a test dummy. Additionally, the NPRM announced that the agency has not yet developed any alternative surrogate measurements for comfort and convenience in rear seating positions. As was the case with crash testing requirements discussed above, NHTSA did not believe it would be appropriate to delay this rulemaking to allow the agency to develop a full set of comfort and convenience requirements.

NHTSA noted that the requirements in S7.4.6 for seat belt guides and hardware would apply to rear-seat lap/shoulder belts without proposing any changes to accomplish that. No commenters objected to this result, so safety belts installed in compliance with this rule are subject to those requirements.

The remaining issue in this area concerned tension-relieving devices on rear-seat lap/shoulder belts. In the NPRM, the agency expressed its tenative conclusion that the same considerations should apply to rear seating positions with tension-relieving devices on safety belts as already apply to front seating positions with tension-relieving devices on safety belts. That is, tension-relieving devices are permitted to be installed on front seat safety belts if vehicles that have tension-relieving devices at those seating positions comply with certain special conditions intended to reduce the likelihood of misuse of tension-relieving devices. Those special conditions are set forth in S7.4.2 as follows:

1. The vehicle owner's manual must include an explanation of how the tension-relieving device works and recommend a maximum amount of slack that should be introduced into the belt under normal circumstances (S7.4.2(b);

2. The vehicle must comply with the injury criteria specified in S5.1 of Standard No. 208 during a barrier crash test with the shoulder belt webbing adjusted to introduce the maximum amount of slack recommended by the manufacturer (S7.4.2(c);

3. The vehicle must have an automatic means to cancel any shoulder belt slack introduced into the belt system by a tension-relieving device (S7.4.2(c).

The NPRM explained that the second requirement listed above could not be applied to rear seat lap/shoulder belts, because the agency could not develop dynamic testing procedures for the rear seating positions at this time. However, the notice proposed to apply the other two requirements listed above to rear-seat lap/shoulder belts equipped with tension-relieving devices.

None of the commenters addressed the proposal to require the vehicle owner's manual to include an explanation of how the tension-relieving device works and a recommendation of the maximum amount of slack to be introduced into the safety belt. Hence, that requirement is adopted as proposed, for the reasons explained in the NPRM.

In its comments, GM objected to the proposed requirement for automatic cancellation of slack. GM indicated that automatic cancellation of slack in front-seat lap/shoulder belts is accomplished by either of two means. If the retractor is mounted on the floor or on the pillar near the adjacent door, the manufacturer generally uses a simple cable, which operates when the door is open to cancel the slack. If there are dual spool retractors on the safety belt system, a simple mechanical device triggered by retraction of the lap belt is used to cancel the slack in the shoulder belt. According to GM, "cable routing concerns" make it difficult to use a cable and the current size of dual spool retractors precludes the use of that technology in rear seating positions. This comment concluded by alleging that only "complex, expensive mechanisms" could be used for slack cancellation in rear seating positions. Ford also suggested in its comments that it would be very complex to develop an automatic means for slack

cancellation. Ford stated that all of its slack cancellation mechanisms are activated by opening the adjacent door. Ford also stated that electric slack cancellation mechanisms would be impracticable for rear-seat lap/shoulder belts.

In response to these comments, NHTSA has reexamined its proposal. That proposal was that slack be automatically cancelled either when the belt is unbuckled *or* when the adjacent door is opened. Although not expressly stated by either GM or Ford, the manufacturers' concern appears to be that there is *no* adjacent door for rear seating positions in many of the vehicles that will be subject to these requirements. The effect of the proposal, then, would be to force manufacturers that chose to install tension-relieving devices in rear-seat lap/shoulder belts for passenger vans, extended cab pickups, and the like, to cancel the slack every time the latchplate is unbuckled, because there is no door adjacent to those seating positions.

The agency did not intend such a result. Instead, the agency's intent was to permit the slack to be cancelled either every time the latchplate was unbuckled or each time the door is opened that is designed to allow the occupant of the seating position in question entry and egress to and from the seat. Thus, if a passenger van has a sliding door on the right side of the vehicle that is designed as the means of entry and egress for all rear seat passengers, slack for rear seat lap/shoulder belts in that van must be cancelled either when that sliding door is opened or when the belt latchplate is unbuckled. Similarly, if a two-door convertible has tension-relieving devices for its rear- seat lap/shoulder belts, slack in the rear-seat lap/shoulder belts must be cancelled either when the latchplate is unbuckled or when the door is opened on the same side of the vehicle as the rear outboard seating position.

This approach will permit manufacturers to use, with appropriate modifications, the same slack cancellation mechanism that is activated by the opening of an adjacent door in seating positions that are not immediately adjacent to the door. The agency is not aware of any reasons why cable routing concerns would present any insuperable difficulties for slack cancellation for the rear- seat lap/shoulder belt systems that are not adjacent to a door. Accordingly, S7.4.2(c) of Standard No. 208 has been amended to provide that slack must be cancelled automatically either when the latchplate is unbuckled or when the door that is designed to provide entry and egress for that seating position is opened.

Both Ford and GM also commented that there was no safety need for automatic cancellation of slack in rear-seat lap/shoulder belts. GM stated that it was not aware of any data showing a safety need for automatic of slack cancellation. Ford commented that there was no possibility of safety belts getting tangled in the door when there was no door adjacent to the seating position at which the tension-relieving device is installed.

NHTSA has previously explained the safety need for automatic slack cancellation in belts equipped with tension-relieving devices. Persons interested in reviewing those discussions may examine 50 CFR 14580; April 12, 1985 and 54 FR 29047; July 11, 1989. Ford and GM did not raise any new arguments that have not already been considered and rejected by the agency. Accordingly, this rule incorporates a requirement for automatic slack cancellation. NHTSA notes that it is currently reviewing a petition that asks the agency to prohibit tension-relieving devices altogether.

8. Relationship of This Rule to Standard No. 210

As noted in the NPRM, section S4.1.1 of Standard No. 210 provides that seat belt anchorages for a Type 2 seat belt assembly (lap/shoulder belt) shall be installed for each forward-facing outboard designated seating position in passenger cars other than convertibles, and for each designated seating position for which a Type 2 seat belt assembly is required by Standard No. 208 in vehicles other than passenger cars. The NPRM proposed to delete Standard No. 210's exemption for convertibles, because the agency was proposing to amend Standard No. 208 to require rear-seat lap/shoulder belts in convertibles. Obviously, there would be lesser benefits from requiring rear-seat lap/shoulder belts in convertibles if those lap/shoulder belts are not required to be effectively anchored to the vehicle. No commenter objected to this proposal, so it is adopted as proposed.

No amendment is needed to ensure that the rear-seat lap/shoulder belts required in other vehicle types covered by this rule will be effectively anchored to the vehicle. As explained above, the existing language of S4.1.1 of Standard No. 210 automatically requires anchorages for lap/shoulder belts to be provided at seating positions required by Standard No. 208 to have lap/shoulder belts.

9. Timing for Applying These New Requirements

Some of the requirements specified in this rule apply to both the vehicle types addressed exclusively in this rule (convertible passenger cars, light trucks, MPVs, and small buses) and to the vehicle type previously addressed in NHTSA's June 14, 1989 final rule (passenger cars other than convertibles). These requirements include the types of retractors that can be installed on rear-seat lap/shoulder belts and special performance requirements for tension-relieving devices installed on rear seat-lap/shoulder belts.

The NPRM proposed that these general requirements, as well as the new requirement that rear-seat

lap/shoulder belts be installed, apply to the vehicle types addressed exclusively in this rule for all such vehicles manufactured on or after September 1, 1991. None of the commenters has provided any evidence demonstrating that the amount of leadtime would be inadequate. Accordingly, the requirements in this rule will apply to convertible passenger cars, light trucks, MPVs and small buses as of September 1, 1991, as was proposed. Earlier compliance is also permitted and encouraged.

With respect to passenger cars, the June 14, 1989 final rule established certain general requirements applicable to cars manufactured on or after September 1, 1990. These general requirements included a requirement that rear-seat lap/shoulder belts be integral and that the upper anchorage for the rear-seat lap/shoulder belt comply with the location requirements of Standard No. 210. The general requirements of this rule for rear-seat lap/shoulder belts (retractor type and special requirements for tension-relieving devices) will apply on or after September 1, 1991, the same data as the other requirements mandated by this rule take effect. The general requirements of this rule will require greater changes, and thus longer leadtime, than the general requirements announced in the June 14, 1989 rule. Accordingly, passenger cars manufactured on or after September 1, 1991 must comply with the retractor type and tension-relieving device requirements set forth in this rule.

In consideration of the foregoing, 49 CFR Part 571.208 is amended as follows:

S4.1.4 of Standard No. 208 is revised to read as follows:

S4.1.4 *Passenger cars manufactured on or after September 1, 1989.*

S4.1.4.1 Except as provided in S4.1.4.2, each passenger car manufactured on or after September 1, 1989 shall comply with the requirements of S4.1.2.1. Any passenger car manufactured on or after September 1, 1989 and before September 1, 1993 whose driver's designated seating position complies with the requirements of S4.1.2.1(a) by means not including any type of seat belt and whose right front designated seating position is equipped with a manual Type 2 seat belt so that the seating position complies with the occupant crash protection requirements of S5.1, with the Type 2 seat belt assembly adjusted in accordance with S7.4.2, shall be counted as a vehicle complying with S4.1.2.1. A vehicle shall not be deemed to be in noncompliance with this standard if its manufacturer establishes that it did not know in the exercise of due care that such vehicle is not in conformity with this standard.

S4.1.4.2 (a) Each passenger car, other than a convertible, manufactured before December 11, 1989 may be equipped with, and each passenger car, other than a convertible, manufactured on or after December 11, 1989 and before September 1, 1990 shall be equipped with a Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed pursuant to this provision shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1.1 of this standard.

(b) Except as provided in S4.1.4.2.1, each passenger car other than a convertible manufactured on or after September 1, 1990 and each convertible passenger car manufactured on or after September 1, 1991 shall be equipped with an integral Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.2 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.1.4.2.1 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.1.4.2 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.1.4.2.2 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requirements of S4.1.4.2, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

3. A new S4.2.4 is added to Standard No. 208, to read as follows:

S4.2.4 *Trucks and multipurpose passenger vehicles manufactured on or after September 1, 1991 with a GVWR of 10,000 pounds or less.*. Except as provided in S4.2.4.2, each truck and each multipurpose passenger vehicle, except a motor home, manufactured on or after September 1, 1991 that has a gross vehicle weight rating of 10,000 pounds or less shall be equipped with an integral Type 2 seat belt assembly at every forward-

facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.2.4.1 As used in this section —

(a) "Motor home" means a motor vehicle with motive power that is designed to provide temporary residential accommodations, as evidenced by the presence of at least four of the following facilities: cooking; refrigeration or ice box; self-contained toilet; heating and/or air conditioning; a portable water supply system including a faucet and a sink; and a separate 110-125 volt electrical power supply and/or an LP gas supply.

(b) "Rear outboard designated seating position" means any "outboard designated seating position" (as that term is defined at 49 CFR 571.3) that is rearward of the front seat(s), except any designated seating positions adjacent to a walkway located between the seat and the side of the vehicle, which walkway is designed to allow access to more rearward seating positions.

S4.2.4.2 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.2.4 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.2.4.3 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requrements of S4.2.4, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

4. A new S4.4.3 is added to Standard No. 208, to read as follows:

S4.4 *Buses.*

* * * * *

S4.4.3 Buses manufactured on or after September 1, 1991.

S4.4.3.1 Each bus with a gross vehicle weight rating of more than 10,000 pounds shall comply with the requirements S4.4.2.1 or S4.4.2.2.

S4.4.3.2 Except as provided in S4.4.3.2.2, each bus with a gross vehicle weight rating of 10,000 pounds or less, except a school bus, shall be equipped with an integral Type 2 seat belt assembly at the driver's designated seating position and at the front and every rear forward-facing outboard designated seating position, and with a Type 1 or Type 2 seat belt assembly at all other designated seating positions. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.4.3.2.1 As used in this section, a "rear outboard designated position" means any "outboard designated seating position" (as that term is defined at 49 CFR 571.3) that is rearward of the front seat(s), except any designated seating positions adjacent to a walkway located between the seat and the side of the vehicle, which walkway is designed to allow access to more rearward seating positions.

S4.4.3.2.2 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.4.3.2 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.4.3.2.3 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requirements of S4.4.3.2, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

S4.4.3.3 Each school bus with a gross vehicle weight rating of 10,000 pounds or less shall be equipped with an integral Type 2 seat belt assembly at the driver's designated seating position and at the right front passenger's designated seating position (if any), and with a Type 1 or Type 2 seat belt assembly at all other designated seating positions. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. The lap belt portion of a Type 2 seat belt assembly installed at the driver's designated seating position and at the right front passenger's designated seating position (if any) shall include either an emergency locking retractor or an automatic locking retractor, which retractor shall not retract webbing to the next locking position until at least 3/4 inch of webbing has moved into the retractor. In determining whether an automatic locking retractor complies with this requirement, the webbing is extended to 75 percent of its length and the retractor is locked after the initial adjustment. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

5. S7.1.1 of Standard No. 208 is amended by revising S7.1.1.3 and by adding a new S7.1.1.5, to read as follows:

S7.1 *Adjustment.*

*   *   *   *   *

S7.1.1.3 A Type 1 lap belt or the lap belt portion of any Type 2 seat belt assembly installed at any outboard designated seating position of a vehicle with a gross vehicle weight rating of 10,000 pounds or less to comply with a requirement of ths standard, except walk-in van-type vehicles and school buses, shall meet the requirements of S7.1 by means of any emergency locking retractor that conforms to Standard No. 209 (49 CFR 571.209).

*   *   *   *   *

S7.1.1.5 Seat belt assemblies installed at a seating position other than the driver's position that incorporate an emergency locking retractor in the lap belt or the lap belt portion of a Type 2 seat belt assembly shall provide some means other than an external device that requires manual attachment or activation to lock the lap belt or lap belt portion, by preventing additional webbing from spooling out, so that the seat belt assembly can be used to tightly secure a child restraint system.

6. S7.4.2 of Standard No. 208 is amended by revising the introductory text and S7.4.2(c), to read as follows:

S7.4.2 *Webbing tension-relieving device.* Each vehicle with an automatic seat belt assembly or with a Type 2 manual seat belt assembly that must meet the occupant crash protection requirements of S5.1 of this standard installed at a front outboard designated seating position, and each vehicle with a Type 2 manual seat belt assembly installed at a rear outboard designated seating position in compliance with a requirement of this standard, that has either automatic or manual tension-relieving devices permitting the introduction of slack in the webbing of the shoulder belt (e.g., "comfort clips" or "window-shade" devices) shall:

*   *   *   *   *

(c) Have, except for open-body vehicles with no doors, and automatic means to cancel any shoulder belt slack introduced into the belt system by a tension-relieving device. In the case of an automatic safety belt system, cancellation of the tension-relieving device shall occur each time the adjacent vehicle door is opened. In the case of a manual seat belt required to meet S5.1, cancellation of the tension-relieving device shall occur, at the manufacturer's option, either each time the adjacent door is opened or each time the latchplate is released from the buckle. In the case of a Type 2 manual seat belt assembly installed at a rear outboard designated seating position, cancellation of the tension-relieving device shall occur, at the manufacturer's option either each time the door designed to to allow the occupant of that seating position entry and egress of the vehicle is opened or each time the latchplate is released from the buckle. In the case of open-body vehicles with no doors, cancellation of the tension-relieving device may be done by a manual means.

§571.210 [Amended]

7. S4.1.1 of Standard No. 210 is revised to read as follows:

S4.1.1 Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each forward-facing outboard designated seating position in passenger cars other than convertibles and for each designated seating position for which a Type 2 seat belt assembly is required by Standard No. 208 (49 CFR 571.208) in vehicles other than passenger cars. Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each rear forward-facing outboard designated seating position in convertible passenger cars manufactured on or after September 1, 1991.

§571.222 [Amended]

8. S5(b) of Standard No. 222 is revised to read as follows:

S5. Requirements. (a)   *   *   *

(b) Each vehicle with a gross vehicle weight rating of 10,000 pounds or less shall be capable of meeting the following requirements at all seating positions other than the driver's seat:

(1)(A) In the case of vehicles manufactured before September 1, 1991, the requirements of §§571.208,

571.209, and 571.210 as they apply to multipurpose passenger vehicles; or

(B) In the case of vehicles manufactured on or after September 1, 1991, the requirements of S4.4.3.3. of §571.208 and the requirements of §§571.209 and 571.210 as they apply to school buses with a gross vehicle weight rating of 10,000 pounds or less; and

(2) The requirements of S5.1.2, S5.1.3, S5.1.4, S5.1.5, and S5.3 of this standard. However, the requirements of §§571.208 and 571.210 shall be met at W seating positions in a bench seat using a body block as specified in Figure 2 of this standard, and a particular school bus passenger seat (i.e., a test specimen) in that weight class need not meet further requirements after having met S5.1.2 and S5.1.5, or after having been subjected to either S5.1.3, S5.1.4, or S5.3 of this standard or §571.210.

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Issued on: October 27, 1989.

Jeffrey R. Miller
Acting Administrator

54 F.R. 46257
November 2, 1989

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages
(Docket No. 87-02; Notice 2)
RIN 2127-AA95

ACTION: Final rule.

SUMMARY: This rule makes several amendments to the safety standard regulating seat belt assembly anchorages. Specifically, this rule:

1. Increases the minimum lap belt angle to reduce the likelihood of occupant submarining in a crash (i.e., the occupant sliding forward and under the safety belt in a crash);

2. Exempts front outboard designated seating positions equipped with automatic safety belts or dynamically tested manual safety belts from the requirement that those positions also be equipped with anchorages for manual lap/shoulder belts. This exemption will remove an unnecessary and redundant regulatory requirement without reducing occupant safety;

3. Permits the optional use of some new test equipment for compliance testing to make the compliance tests simpler and less costly to perform; and

4. Clarifies some ambiguities in the current compliance testing procedures so that all parties will know precisely how compliance testing will be conducted by the agency.

EFFECTIVE DATES: The amendments made in this rule are effective as of September 1, 1992, except for the amendment to S4.1.3, which takes effect April 30, 1990.

SUPPLEMENTARY INFORMATION: Federal Motor Vehicle Safety Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR §571.210) sets forth performance requirements for safety belt anchorages to ensure their proper location for effective occupant protection and to reduce the likelihood of the anchorage's failure in a crash. The requirements of the standard that applies to passenger cars, trucks, buses, and multipurpose passenger vehicles establish zones within the vehicle where an anchorage must be located and the forces that an anchorage must be capable of withstanding during a static strength test.

BL Technology, Ltd., General Motors, and Mercedes-Benz each petitioned the agency to amend different aspects of Standard No. 210. Additionally, NHTSA's experience conducting its compliance testing under Standard No. 210 indicated a need to modify or clarify some aspects of the standard. Accordingly, the agency published a notice of proposed rulemaking (NPRM) on February 3, 1987 (52 FR 3293).

NHTSA received 28 comments in response to this NPRM. All of these comments were considered while formulating this final rule, and the most significant comments are addressed below. This preamble uses the same organization as the NPRM's preamble, to aid the reader in comparing the two documents.

I. *Anchorage Strength Test Procedures*

Standard No. 210 uses a laboratory test instead of a crash test to measure the strength of safety belt anchorages. In a laboratory, or "static" test, forces are slowly applied to the anchorages for a period of up to 30 seconds. In a crash, or "dynamic" test, forces are quickly applied and last for less than a second. Standard No. 210 currently specifies the minimum loads that the anchorage must withstand in a laboratory test, the maximum rate of increase in applying that load to the anchorage, and a minimum period of ten seconds during which the anchorage must withstand the specified load.

BL Technology, Ltd. (BL) filed a petition asking the agency to amend Standard No. 210 to harmonize the anchorage strength test procedure with the Economic Commission for Europe (ECE) Regulation No. 14 on safety belt anchorages. The ECE regulation uses a non-crash static or quasi-dynamic test procedure to evaluate the strength of the anchorage. Although the ECE regulation requires anchorages to be subjected to virtually the identical load as does Standard No. 210, the ECE regulation specifies a load application rate of "as fast as possible" for the anchorages and a much shorter period during which the anchorage must withstand the load. BL argued that adopting the ECE test procedure would reduce vehicle weight and cost. More specifically, BL said that additional welds and reinforcing brackets are

necessary on a vehicle to allow its anchorages to withstand the 10-second load duration of Standard No. 210, but such structural reinforcement is not required to meet the 0.2-second load duration of ECE Regulation No. 14. BL also argued that the static test procedure of Standard No. 210 is not representative of real world crash conditions.

In response to this petition, the agency acknowledged in the NPRM that the static test procedure of Standard No. 210 imposes a load for a longer period of time on an anchorage than is imposed in a real crash or a crash test. The agency also acknowledged in the NPRM that metal structures can withstand greater forces under dynamic loading than under static loading. This means that an anchorage that fails at a given force level under the static loading conditions of Standard No. 210 would not necessarily fail if exposed to that same force level under dynamic loading conditions. To this extent, then, NHTSA agrees with BL's assertion that Standard No. 210's test procedure is not representative of actual crashes.

However, NHTSA was concerned that a potential reduction in safety could result from adopting BL's request to harmonize Standard No. 210's anchorage requirements with those of ECE Regulation No. 14. Because metals can withstand larger force levels under dynamic loading than under static loading, a decision to retain the same force levels but shift from static loading to dynamic loading would allow the use of metals of lesser strength for the anchorage. However, this possibility could be avoided if such a decision were accompanied by a decision to increase the ultimate test load and anchorage is required to withstand or to require the safety belt/anchorage system to meet other occupant crash protection requirements. To more fully explore this topic, the NPRM solicited comments on three possible changes to the anchorage strength requirements. The agency stated in the NPRM that, based on its evaluation of the comments received on the NPRM and on its continuing assessment of test data from the New Car Assessment Program (NCAP) and other crash tests, NHTSA would determine whether changes in the anchorage test procedures or anchorage load requirements were appropriate or necessary.

A. *Exclusion of Anchorages for Dynamically Tested Manual Belt Assemblies from the Strength Requirements*

In comments on other rulemaking actions addressing the dynamic testing of manual belt assemblies, a number of vehicle manufacturers had requested that the anchorages for dynamically tested manual safety belt assemblies be excluded from the strength requirements of Standard No. 210. These manufacturers argued that requiring a safety belt system to meet the injury criteria of Standard No. 208 measured on test dummies in a crash test is sufficient assurance that vehicle occupants will be adequately protected in a real-world crash. In the NPRM, NHTSA sought comments on whether this argument was persuasive, or whether the strength requirements ought to be retained to assure adequate protection for occupants larger than the 50th percentile adult male (the size of the test dummy used in crash testing) or to assure adequate protection after the anchorage is exposed to corrosion or other forms of potential anchorage weakening over the vehicle's life.

In response to this request for comments, nine commenters (Volvo, Austin, Chrysler, Ford, GM, Fiat, Toyota, Mazda, and the Motor Vehicle Manufacturers Association) stated that anchorages for dynamically tested belt assemblies should be excluded from Standard No. 210's strength requirements. Mercedes-Benz commented that anchorages for dynamically tested belt assemblies should *not* be excluded from Standard No. 210's strength requirements. According to this comment, the strength requirements for anchorages of dynamically tested safety belt assemblies help assure effective protection for occupants in crashes with impact speeds greater than 30 mph and occupants whose properties exceed those of the 50th percentile adult male.

After reconsidering this issue, the agency has decided to maintain the current requirement that the anchorages for dynamically tested safety belts are subject to the anchorage strength requirements of Standard No. 210. First, NHTSA believes that the strength requirements help assure that the safety belt assembly and anchorage will afford effective protection under conditions more severe than those for dynamic testing (i.e., occupants larger than 50th percentile adult male, crash speed greater than 30 mph, etc.). Mercedes concurred with this judgment in its comments. On the other hand, none of the commenters that supported an exclusion from the strength requirements for dynamically tested manual belts addressed the need for occupant protection under conditions more severe than those encountered in the dynamic testing.

Second, the agency believes that the requirements for dynamically tested manual and automatic safety belts should be consistent, at least insofar as the dynamic testing common to both types of safety belts is the basis for the requirement. NHTSA has expressly and consistently stated for more than 10 years that anchorages for automatic safety belts are *not* excluded from the strength requirements of Standard No. 210. *See* the agency's July 26, 1978 interpretation letter to Mr. Toko Iinuma and the July 23, 1980 letter to Mr. M. Ogata. Since the agency has not found the dynamic testing of auto-

matic belts to be a sufficient justification for excluding automatic belt anchorages from the strength requirements of Standard No. 210, it would be inconsistent for the agency to now conclude that the same dynamic testing *is* a sufficient justification for excluding the anchorages for manual safety belts from the strength requirements of Standard No. 210.

Third, the agency continues to believe that a margin of safety in anchorage strength is a reasonable surrogate for corrosion or other forms of potential anchorage weakening that might be encountered over a vehicle's life. General Motors (GM) took issue with this hypothesis in its comments, stating that "the likelihood of a correlation between the results of Standard No. 210 anchorage strength testing and the potential for anchorage weakening is remote." However, GM conceded that it had no data to refute this position. NHTSA did not intend to suggest that anchorages that were stronger when new would be less likely to weaken while in service. However, NHTSA is unaware of, and no commenter tried to offer, any reason why an anchorage with a higher nominal strength than another anchorage when new would not retain a relative strength advantage over the weaker anchorage when both are degraded by factors, such as stress or corrosion, to which anchorages may be exposed while a vehicle is in service.

B. *Harmonization with ECE*

The NPRM requested comments on revising the strength test of Standard No. 210 to be similar to the requirements of ECE Regulation No. 14. Both Regulation No. 14, and the newer ECE Regulation 14.02, specify anchorage strength requirements, and require an anchorage to be subjected to a load nearly identical to that currently specified in Standard No. 210 (3,035 pounds for shoulder belt in ECE vs. 3,000 pounds in Standard No. 210, and 5,002 pounds for lap belt in ECE vs. 5,000 pounds in Standard No. 210). However, the ECE regulations specify that the load be held for 0.2 seconds, as opposed to the 10 second load hold currently specified by Standard No. 210, and that the load be applied "as rapidly as possible," as opposed to the provisions in Standard No. 210 that the load be attained in as little time as possible but in not more than 30 seconds. Since the ECE requirement that the load be applied "as rapidly as possible" would not satisfy the requirement in the National Traffic and Motor Vehicle Safety Act that each safety standard "be stated in objective terms," NHTSA requested comments on retaining the maximum force onset rates currently specified in Standard No. 210 (50,000 pounds per second for lap belts and 30,000 pounds per second for lap/shoulder belts), and that the specified force levels be attained in not more than 5 seconds, compared with the 30 seconds currently specified in Standard No. 210.

Many commenters supported these proposed changes, arguing that these periods for attaining and holding the required loads would be more representative of real world crash situations. Additionally, some of those commenters stated that they have never seen a single anchorage failure on vehicles with anchorages certified to the ECE requirements. While nearly all commenters agreed with the proposal to shorten the time for which the load must be held by the anchorage to 0.2 seconds, Ford, GM, and Jaguar suggested that the 5-second period proposed for attaining the specified load be further shortened. Ford commented that the proposed 5-second period in which to attain the load should be shortened to harmonize with the ECE "as rapidly as possible" requirement. GM commented that the 5-second period in which to attain the specified load would be unrepresentative of loading in crashes, and stated that it appears to be practicable with newer testing equipment to attain the specified load in 1.0 second. Jaguar commented that some newer test equipment can apply the specified load in less than 0.3 seconds, and suggested that the rule should be amended to require the specified loading to be attained in not more than 0.3 seconds. Mitsubishi, on the other hand, supported the proposal to lower to 0.2 seconds the time the anchorage must hold the specified load, but objected to the proposal that the specified loading be attained in 5 seconds. According to this commenter, the proposal to require the specified load to be attained in 5 seconds would necessitate either extensive modifications of existing testing equipment or the purchase and installation of new testing equipment.

NHTSA has carefully reconsidered this subject after reviewing these comments. Safety requirements can evaluate the performance of safety equipment by following two general approaches. These approaches are as follows:

1. The safety requirements can evaluate performance by providing for test conditions that simulate actual crash conditions. The advantage of this approach is that it permits an evaluation of the occupant protection capabilities of all the systems in a vehicle in a single test. To the extent that those systems work synergistically, that synergism will be reflected in the test. Examples of safety standards that use test conditions that simulate an actual vehicle crash are Standard No. 208, *Occupant Crash Protection*, and Standard No. 301, *Fuel System Integrity*. It is obviously imperative that test conditions in these and other safety standards intended to simulate crash conditions actually do so.

2. Alternatively, however, safety requirements can evaluate the performance of vehicle safety equip-

ment by providing for test conditions that are structured to ensure that the safety equipment will perform adequately in actual crash conditions *without* simulating those conditions. Test conditions that do *not* simulate actual crash conditions are developed generally where it would be infeasible or too costly to design and/or implement any single test procedure or series of test procedures that reasonably simulate the conditions to which the safety equipment will be exposed, including possible crash conditions and possible degradation over time because of exposure to environmental factors. Examples of safety standards that use test conditions *not* intended to simulate an actual vehicle crash are Standard No. 209, *Seat Belt Assemblies*, and Standard No. 210, *Seat Belt Assembly Anchorages*.

The test conditions specified in this latter type of safety requirement are intended to subject the vehicle safety equipment to force or exposure levels that are sufficiently high so that one can reasonably conclude that the equipment is unlikely to fail as a result of exposure to even severe crash conditions or environmental exposures. Such test conditions are necessarily more severe than typical crash conditions, to ensure a margin of safety in the standard. That is, even if the test conditions were not directly representative of actual crash conditions, the test conditions are so demanding that one can confidently predict that equipment that withstands the test conditions will withstand most crash conditions, even severe crash conditions.

Hence, it is *not* a telling point to assert that the loading conditions for the anchorage strength test in Standard No. 210 do not simulate actual crashes. These test conditions admittedly do not simulate actual crashes, nor are they intended to do so.

Neither the current Standard No. 210 anchorage strength test procedures nor the ECE Regulation No. 14 anchorage strength test procedures is a close simulation of actual crash conditions. From sled tests, NHTSA has observed that total loading time for safety belts (including the onset of loading, holding the maximum load, and the release of the loading) ranges from about 0.10 to 0.15 seconds. The observed durations for holding the maximum load were generally less than 0.005 seconds. These time periods should be compared with the 30 second period permitted to attain the load and the 10 second period for holding the maximum load specified in Standard No. 210, and the provisions in the ECE regulation for attaining the load and holding the load for 0.2 seconds.

Both the load onset (up to 30 seconds) and the load holding times (10 seconds) currently specified in Standard No. 210 are admittedly orders of magnitude greater than the corresponding time periods observed in crashes (not more than 0.15 seconds and less than 0.005 seconds, respectively). However, the load onset ("as rapidly as possible," which was said by a commenter to be as little as 0.3 seconds) and load holding (0.2 seconds) times needed for testing for compliance with the ECE regulation are also substantially greater than the corresponding periods observed in crashes. Thus, neither the anchorage strength test in Standard No. 210 nor the anchorage strength test in the ECE regulation is an accurate simulation of actual crash conditions. Instead, both of these anchorage strength tests represent test conditions intended to be sufficiently demanding to ensure that the anchorage will not fail even under the most severe crash conditions.

As noted in the NPRM and by many of the commenters, the anchorage strength test in the ECE regulation is less stringent than the anchorage strength test in Standard No. 210. Adopting the ECE regulation could allow some slight reduction in vehicle weight and costs for the manufacturer by permitting the manufacturer to omit the additional welds and reinforcing brackets that BL's petition stated are necessary to comply with Standard No. 210, but unnecessary to comply with the ECE regulation. Conversely, the agency has no way of confirming with a reasonable degree of confidence that there have been no anchorage failures in actual crashes of vehicles certified as complying with the ECE regulation. Thus, the "margin of safety" provided by the ECE regulation can neither be confirmed nor denied.

In addition, NHTSA continues to observe shoulder belt loads in its New Car Assessment Program (NCAP) tests in excess of the 3,000-pound load to which the shoulder belts are subjected in Standard No. 210 compliance testing. The significance of this is that anchorages will be exposed to higher force levels in some real world crashes than in the compliance testing. To help compensate for this, the compliance testing may either be revised to specify higher force levels or the compliance testing may specify that anchorages shall be subjected to its loads for a longer duration. Standard No. 210's anchorage strength test currently uses this latter approach.

In its comments, Mercedes stated that it had not seen belt loads as high as those recorded in the agency's NCAP test data. Mercedes hypothesized that the technique used for measuring the belt loads in NCAP tests may produce spurious data. To investigate whether such potential error existed in the NCAP test data, NHTSA retrieved and analyzed the digitized shoulder belt transducer signals from three different automobiles in which shoulder belt loads in excess of 3,000 pounds were recorded. These three cars were a 1981 Toyota Cressida, a 1984 Ford Mustang, and a 1986 Oldsmobile Toronado. The shoulder belt loads recorded for the driver and

passenger shoulder belts were plotted as a function of force versus time. If the shoulder belt loads were the result of spurious signals being recorded, that would be expected to show up as inconsistencies between the graphs plotted for the passenger and driver positions in the same vehicle. However, no such inconsistencies were shown on these data graphs. Therefore, the agency has no evidence to support Mercedes' hypothesis that the NCAP data are unreliable. To the contrary, NHTSA's reexamination of the NCAP data leads to the conclusions that the data on belt loads in 35 mile per hour crash tests with 50th percentile male dummies are properly measured and recorded, and that some of the belt loads observed in those tests exceed the 3,000 pound forces to which lap/shoulder belt anchorages are subjected during the compliance testing for Standard No. 210.

NHTSA has decided not to reduce the "margin of safety" currently required for anchorage strength, even to the ECE level. The current anchorage strength test effectively requires vehicle manufacturers to use additional reinforcements at the anchorage points, as compared with what is needed to satisfy the anchorage strength test in the ECE regulation. There is no question that these additional reinforcements are feasible and practicable, since manufacturers have been doing so for more than 20 years. The agency has considered whether the costs and other burdens associated with these reinforcements are excessive in relation to the benefits resulting from these reinforcements. NHTSA estimates that the additional reinforcement typically adds about 4 to 8 ounces of steel at a cost of approximately one dollar per vehicle. Although NHTSA cannot quantify the safety benefits or the actual margin of safety attributable to the additional reinforcements, the agency believes it would be inappropriate to *potentially* reduce the safety protection afforded to vehicle occupants to achieve such minimal cost savings. Thus, this rule does not make any change to the load onset or load holding times for the anchorage strength test in Standard No. 210.

1. *Harmonization of Lap Belt Mounting Angles*

Standard No. 210 currently includes a minimum and maximum mounting angle for lap-only safety belts and for the lap belt portion of lap/shoulder belts. The minimum mounting angle requirement reduces the possibility of occupant submarining. Occupant submarining occurs when an occupant slides forward and under the safety belt during a crash. The possibility of occupant submarining increases as the belt angle approaches the horizontal, that is, as the measured belt angle with the horizontal decreases. The potential hazard of submarining is that occupants may suffer abdominal injuries as they slide under their belts.

Standard No. 210 currently specifies a minimum lap belt angle of 20 degrees above the horizontal, measured from the seating reference point to either the anchorage or the point where the safety belt contacts the seat frame. The ECE regulation specifies a minimum lap belt angle of 30 degrees. Since the ECE 30 degree minimum would enhance safety, by reducing the risk of occupant submarining, the NPRM proposed to adopt a 30 degree minimum in Standard No. 210.

Four of the commenters supported the proposal to require a minimum lap belt angle of 30 degrees. These four were Chrysler, Volvo, Volkswagen, and BMW. On the other hand, twelve commenters (Mitsubishi, Honda, Austin Rover, Fiat, Ford, Hino, GM, Toyota, Jaguar, Nissan, Mazda, and Subaru) opposed this proposed change for several reasons. GM commented that "the interrelationship of factors that can contribute to occupant submarining in vehicle crashes is not fully understood." Both Ford and Hino commented that occupant submarining depends on factors other than belt angle.

NHTSA agrees with Ford and Hino that factors other than belt angle, including characteristics of the safety belt webbing, the seat, the occupant, and the type and direction of the crash itself, affect the likelihood of occupant submarining. NHTSA also agrees with GM that the interrelationship of these factors is not fully understood. However, even though other factors can affect the likelihood of occupant submarining and even though the interrelationship of these factors is not yet quantified, the available data show that increasing the minimum lap belt angle will decrease the likelihood of occupant submarining. If all of the other factors that influence submarining are held constant and only the angle of the lap belt is changed, the angle of the lap belt in relation to the constraining forces will greatly affect the likelihood that the belt will ride over the iliac crest (the pelvic bone) in a crash. Too shallow a belt angle results in insufficient downward force to resist the upward motion of the lap belt that results from restraining an occupant in any crash. Since an increase in the minimum lap belt angle from 20 to 30 degrees would reduce the likelihood of occupant submarining, and thereby enhance occupant safety, the fact that other factors might also enhance occupant safety does not seem a compelling reason for not requiring an increase in the minimum lap belt angle.

A number of commenters stated that the ECE regulation requires a minimum lap belt angle of 30 degrees *only* in passenger cars, and even for those vehicles *only* in the front seats. Otherwise, the ECE regulation specifies a minimum lap belt angle of 20

degrees. These commenters suggested that NHTSA should harmonize precisely with the ECE regulation if this rulemaking was to achieve its stated intent.

NHTSA's intent in this and all of its other efforts to harmonize this agency's regulations with those of other nations is to eliminate needless differences between international regulatory requirements applicable to vehicles. However, differences that reflect differing conclusions about the safety need for particular regulatory requirements are not what NHTSA considers to be needless differences.

In this case, NHTSA believes that the available data suggest the desirability of establishing a minimum lap belt angle of 30 degrees for all seating positions, irrespective of the fact that ECE specifies a minimum 30 degree lap belt angle only for front seats in passenger cars. NHTSA test data have shown that the occurrence of occupant submarining is diminished as the lap belt angle is increased. ("Rear Seat Submarining Investigation," DOT HS 807–347, May 1988). Conversely, none of the available data suggest that, all other factors being held constant, the likelihood of occupant submarining in response to a shallow belt angle is any less for rear seat than front seat occupants. To the contrary, the lower pelvis-to-heel position of many rear seat occupants may increase the chance of submarining. The agency does not understand the commenters to be making such an assertion. Instead, NHTSA understands the commenters to be suggesting that the other factors that affect the likelihood of occupant submarining are not constant between the front and rear seat of vehicles. Because adjustments to the other factors can be made to compensate for the lesser lap belt angle, the commenters appear to be suggesting that the likelihood of occupant submarining in the rear seat with a lesser lap belt angle with compensating adjustments to other factors is no more than the likelihood of occupant submarining in the front seat with a greater lap belt angle and no compensating adjustments to other factors.

Even if this suggestion were correct and adjustments could be made to counteract the effects of a lap belt angle less than 30 degrees in the rear seat, NHTSA does not believe this is a persuasive reason to permit a lesser lap belt angle in rear seating positions. In such situations, the likelihood of occupant submarining could be even further reduced by increasing the lap belt angle to 30 degrees or more in those rear seats *together with* the compensating changes to other factors identified by the vehicle manufacturer. Since occupant submarining can result in abdominal injuries for belt users, NHTSA believes it is appropriate to take measures to reduce the likelihood of occupant submarining as much as possible. Therefore, this rule specifies a minimum lap belt angle of 30 degrees in all seating positions.

The maximum lap belt mounting angle requirement in Standard No. 210 affects the forward excursion of an occupant in a crash. The probability of forward excursion increases as the belt angle approaches the vertical (i.e., as the belt angle increases) because the safety belt will rotate about the anchorage before it begins to resist the crash forces. The likelihood of occupant contact with vehicle surfaces, and, therefore, the likelihood of occupant injury, increases as the amount of occupant excursion increases.

Standard No. 210 currently specifies a maximum lap belt angle of 75 degrees, measured from the seating reference point to either the anchorage or the point where the safety belt contacts the seat frame. The ECE regulation permits a maximum lap belt angle of 80 degrees. The NPRM asked for accident and test data on whether increasing the maximum lap belt angle to 80 degrees would significantly increase the forward excursion of belt users. No commenter offered any data in response to this request. Chrysler commented that it had no data on this subject, but that its earlier testing experience showed that occupant excursion may increase with an increase in belt angle. Nevertheless, Chrysler stated that it supported an increase in the maximum lap belt angle to 80 degrees. At least five other commenters suggested that NHTSA should adopt the ECE maximum lap belt angle of 80 degrees, in order to further harmonization.

Harmonization should not result in any lessening of safety protection for vehicles sold in the United States. In this case, all of the available data indicate that occupant excursion increases as the maximum lap belt angle increases. Hence, a maximum lap belt angle of 75 degrees, instead of 80 degrees, reduces the likelihood of adult occupant excursion and injury. Additionally, a paper prepared for the Society of Automotive Engineers concluded that child safety seats have a greater propensity for excursion than do adult belt users, and that a shallower lap belt angle is needed to ensure protection for occupants of child safety safety seats; *see* Weber and Radovich, "Performance Evaluation of Child Restraints Relative to Vehicle Lap-Belt Anchorage Location," SAE 870324. Based on a series of 30 mile per hour (mph) sled tests, the Weber and Radovich paper reports that the amount of head excursion for the test dummy in a child safety seat had almost a linear increase with the increase of the lap belt angle. Against this background, NHTSA has no basis for any further consideration of increasing the maximum lap belt angle from the currently specified 75 degrees.

In summary, the lap belt angle should be optimized below the upper excursion limit of 75 degrees

and above the lower submarining limit of 30 degrees. The data available to the agency indicate that lap belts designed with angles within this range should mitigate both of these potential problems. Requirements for lap belt angles to be greater than 30 degrees or less than 75 degrees are outside the scope of this rulemaking. Should additional information become available on this subject, the agency may readdress this subject in a future rulemaking.

2. *Anchorage Deformation Limits*

While structural deformation of the area around an anchorage can aid in occupant protection by absorbing part of the crash energy, excessive deformation can allow excessive occupant excursion, which would allow a belt user to move forward and contact the vehicle's interior. The only limitation on anchorage deformation currently specified in Standard No. 210 is that the anchorage must not completely separate from the vehicle structure. Anything short of complete separation is permissible. ECE Regulation No. 14, on the other hand, limits the permissible deformation of an anchorage during testing. During the test prescribed in ECE Regulation No. 14, the lap belt anchorages must continue to meet the minimum lateral spacing requirement of the regulation and the upper anchorage for the shoulder belt must remain within the zone specified in the regulation. The agency asked for comments on adopting a similar approach in Standard No. 210.

The idea of limiting the permissible anchorage deformation that occurs during compliance testing was necessarily linked with the proposal to modify the current anchorage strength test specified in Standard No. 210, so that the strength test would attain and impose the load in a manner more representative of actual crash loading. If the loading could be imposed on the anchorage in a way that more closely simulated an actual vehicle crash, limits on the deformation of the anchorage could serve a safety purpose, by helping to ensure that safety belt users would not experience excessive excursion in an actual crash.

As explained above, however, the times during which the load is imposed and held by the anchorage during Standard No. 210 compliance testing is unchanged in this final rule. Because this rule does not reduce the load hold time, NHTSA does not believe there is any practical means of complying with the proposed deformation limit, nor is there any safety need for adding the proposed deformation limit to the standard. Agency compliance testing using the current 10 second load hold time demonstrates that some current designs for anchorages would not comply with the proposed deformation limit. In some compliance tests, deformation has been so severe that the tests had to be interrupted because of excessive instrument travel. The only way for such vehicles to comply with this proposed deformation limit for anchorages would be if much of the vehicle structure supporting the anchorages were redesigned.

It is not clear that real world safety benefits would be realized sufficient to justify imposing a requirement for major redesign of vehicles. The load imposition and load hold times specified for compliance testing are admittedly not directly representative of actual crash conditions. Since the anchorage strength test is not directly representative of actual crash conditions, it is not clear that imposing new deformation limits for the anchorages during that strength test would enhance occupant safety during actual crash conditions. Moreover, the available accident data do not indicate that current vehicles, which are *not* subject to any limitations on anchorage deformation, pose any significant safety risk to occupants wearing safety belts, as a result of excessive anchorage deformation. This suggests that there is no safety basis for changing the existing regulatory structure. Accordingly, no anchorage deformation limits have been adopted in this rulemaking.

3. *Upper Anchorage Location Zone*

As noted in the NPRM, Standard No. 210 and ECE Regulation No. 14 specify limits on the zones in which the upper anchorage for the shoulder portion of lap/shoulder belts can be located. The ECE regulation differs from Standard No. 210 in that the ECE regulation permits an anchorage to be located further forward than does Standard No. 210. In fact, the ECE regulation permits the upper anchorage for a shoulder belt to be located in front of an occupant's shoulder.

The NPRM noted that the agency is aware of test data showing that an anchorage positioned in front of an occupant's shoulder can allow increased head movement and thus potentially increase the risk of head injury. The NPRM identified three different studies that supported this conclusion. On the other hand, the NPRM also noted that the agency was aware of one set of test data indicating that the increased head movement from anchorage locations forward of the shoulder may not significanly increase the risk of head injury. The agency sought comments on whether to adopt the upper anchorage location zone specified in the ECE regulation, and stated in the NPRM that it was particularly interested in receiving additional accident and/or test data on the safety effects of permitting anchorages to be located in front of an occupant's shoulder.

No commenter provided any such data in response to this request. Without discussing any potential safety implications, many of the commenters urged NHTSA to harmonize Standard No. 210's requirements with those in the ECE regulation. As ex-

plained above, NHTSA cannot take any steps to harmonize its safety standards with other countries' vehicle regulations until the agency has carefully considered the safety consequences of such steps. In this case, the data appear conflicting, but the preponderance of the evidence suggests that permitting the upper anchorage to be located in front of an occupant's shoulder would potentially increase the risk of head injury. Until such time as it is clearly demonstrated that permitting anchorage locations in front of an occupant's shoulder does not pose an increased risk of injury, NHTSA believes it is inappropriate to permit such anchorage locations. Hence, this rule makes no change to the location zone currently specified in Standard No. 210 for upper anchorages subject to the standard's location requirement.

4. *Lateral Spacing of Lap Belt Anchorages*

Standard No. 210 currently specifies a minimum lateral spacing of 6.5 inches for lap belt anchorages, while the ECE regulation requires a minimum of 13.75 inches lateral spacing for lap belt anchorages. In the NPRM, the agency stated that it recognized that the closer the spacing of lap belt anchorages, the greater the possibility of increased lateral movement by a belt user during an oblique, side, or rollover crash. In addition, NHTSA stated that closer spacing of anchorages could permit increased side loads on an occupant's pelvis. However, the agency acknowledged that it did not have any data indicating that the possible side loads and lateral movement do, in fact, present an increased risk of injury. Thus, the NPRM asked for comments and data on the effect of anchorage spacing on occupant safety.

Fiat and Volvo commented that they would support an amendment of Standard No. 210 to adopt the ECE anchorage spacing requirement, although neither commenter provided any data to support such an amendment. Fiat repeated the agency's assertion that close spacing of lap belt anchorages could permit increased side loading. Volvo asserted that wider spacing of lap belt anchorages would enable the lap belt to "better secure child safety seats," but did not explain why this would be so. NHTSA assumes that Volvo was alluding to the issue of sideward excursion that was noted in the NPRM for adult users of the safety belt.

On the other hand, several commenters suggested that there was no need to change the existing lap belt anchorage spacing requirement. GM commented that further study is needed before considering any changes. Similarly, Navistar commented that the agency should have sound data before making any change to the anchorage spacing requirements. Blue Bird commented that the ECE 13.75 inch spacing for lap belt anchorages would "be difficult to accomplish" for school bus seats, because those seats are generally designed to allow 13.0 inch rump room for passengers. Chrysler commented that there are no data showing a safety need to increase the anchorage spacing from the 6.5 inches that has been specified for the past 20 years. Ford also commented that there were no safety data showing the need for a change, and added that a requirement for 13.75 inch anchorage spacing would require a redesign in current vehicles with center seating positions.

NHTSA agrees with the commenters that stated that there should be a sound safety basis for a requirement that will force manufacturers to change vehicle designs, particularly when such designs have been expressly permitted by the safety standards for the preceding 20 years. With respect to lap belt anchorage spacing, there are three possible safety considerations that could serve as a basis for increased anchorage spacing. First, closer spacing could permit increased lateral movement in an oblique, side, or rollover crash. Even accepting this as true, NHTSA is unaware of any data, from either laboratory testing or real world crashes, that indicate a serious risk of injury as a result of this increased lateral movement. Given the number of vehicles that have used anchorage spacing narrower than is specified by ECE, especially at center seating positions, it seems reasonable to conclude that the absence of any data to the contrary shows that the anchorage spacing currently specified in Standard No. 210 does not permit any serious risk of injury to motor vehicle occupants as a result of lateral movement in crashes. Second, closer spacing of lap belt anchorages could create injurious inward sideloading on the pelvis of the occupant during a frontal crash. However, the agency's examination of accident data and studies indicates that, to the extent belt users experience pelvic injuries like hip dislocations and fractures, those injuries are the result of the crash forces driving the occupant's knee back into the hip, *not* the safety belt loads being applied directly to the hip. *See, e.g.,* Otte, Dietmar, "Residual Injuries to Restrained Car Occupants in Frontal and Rear Seat Positions," Accident Research Unit, Hannover, West Germany (May 1987). This being the case, there is no reason to believe that a regulatory change to reduce potential inward belt loading on the pelvis, by mandating the wider anchorage spacing in the ECE regulation, would achieve any significant reduction in the number of pelvic injuries to occupants. Third, the possibility of submarining was investigated in a research study (Leung, C.Y., *et al.,* "Submarining Injuries of 3 Point Belted Occupants in Frontal Collisions—Description, Mechanisms, and Protection," SAE 821158). After a series of tests, the Leung study found that the likelihood of occupant submarining decreases as the lap belt anchorage spacing decreases. Hence, adopt-

ing the wider anchorage spacing specified in the ECE regulation would not reduce the likelihood of occupant submarining.

NHTSA also notes that the narrower spacing requirement in Standard No. 210 gives manufacturers more design latitude than the corresponding ECE requirement. Manufacturers that wish to certify compliance with the anchorage spacing requirements in both Standard No. 210 and the ECE requirements can do so by merely spacing the anchorages in its vehicles more widely than the ECE's minimum 13.75 inches.

Since the agency is not aware of evidence showing any significant safety benefits that would be associated with the ECE lap belt anchorage spacing requirements, and adopting the ECE lap belt minimum anchorage spacing requirements would impose some additional costs by requiring modifications to some existing vehicle designs, this rule does not make any changes to the minimum lap belt anchorage spacing requirements currently specified in Standard No. 210.

5. *Simultaneous Testing of Anchorages*

Standard No. 210 currently requires that all *floor-mounted* anchorages for *adjacent* designated seating positions be tested simultaneously for anchorage strength. ECE Regulation No. 14 requires that *all* anchorages common to a single seat assembly, whether floor-mounted or mounted on the seat frame, be tested simultaneously. This ECE requirement ensures that the anchorages for all *three* seating positions on a standard passenger car bench seat will be tested simultaneously. In the NPRM, the agency noted that the requirement in the ECE regulation is more representative of a real-world crash in which all seating positions are occupied. Accordingly, the agency proposed to adopt a requirement that all anchorages common to one seat be tested simultaneously.

Five commenters addressed this proposal. Three of the commenters (Volvo, Austin Rover, and Chrysler) supported the proposal for the reasons set forth in the NPRM. Ford also commented that it supported the proposal, but asked for some clarification of the relationship between the compliance testing for Standard No. 210 and that specified in Standard No. 207, *Seating Systems* (49 CFR 571.207). Section S4.2(c) of Standard No. 207 provides that, if the seat belt assembly is attached to the seat being tested, the forces specified for Standard No. 207 compliance testing shall be applied simultaneously with the forces specified for Standard No. 210 compliance testing of the seat. Ford asked that Standard No. 210 be amended to provide that the Standard No. 207 compliance test forces be applied simultaneously with those of Standard No. 210. No such change has been made, because Standard No. 207 already contains a provision for simultaneous testing. Therefore, NHTSA does not believe a conforming cross-reference in Standard No. 210 is necessary. Ford also asked that Standard No. 207 be amended to provide that a seat that has been subjected to the simultaneous loading need not pass any further seat loading tests. Whatever the merits of this request, it is outside the scope of this rulemaking action.

Blue Bird, a manufacturer of school buses, commented that a requirement for simultaneous testing of all anchorages common to one seat assembly, regardless of whether the anchorages were mounted on the vehicle floor or the seat frame, "would be extremely difficult and expensive to meet." Blue Bird "strongly requested" that a requirement for simultaneous testing of all anchorages for any given seat assembly be carefully studied and the safety need conclusively established before making this requirement applicable to passenger seats on school buses.

Section S4.1.2 of Standard No. 210 provides that school buses with a gross vehicle weight rating (GVWR) of more than 10,000 pounds are *not* required to have anchorages installed for the passenger seats. Any anchorages that are installed for passenger seating positions in those school buses would be purely voluntary, and not in response to any regulatory requirement. Thus, any anchorages for safety belts that are installed on the passenger seats in large school buses are not subject to any of the anchorage requirements specified in Standard No. 210.

This is not the case for anchorages installed for the passenger seats in school buses with a GVWR of 10,000 pounds or less. Those seats are required by section S5(b) of Standard No. 222, *School Bus Passenger Seating and Crash Protection* (49 CFR 571.222) to comply with the requirements of Standard No. 210 as those requirements apply to multipurpose passenger vehicles. Accordingly, S4.1.2 of Standard No. 210 requires that anchorages for either a lap-only belt or a lap/shoulder belt be installed for each passenger seating position in small school buses. Thus, a forward-facing bench seat on a small school bus that has three passenger seating positions would be tested by simultaneously loading the anchorages for all three of those passenger seating positions.

NHTSA believes it is appropriate to require simultaneous testing of anchorages for the passenger seats in small school buses for a number of reasons. First, a requirement for simultaneous testing of passenger seat anchorages is more representative of real world crash conditions with all seating positions occupied for small school buses, just as the simultaneous testing requirement is more representative of real world crash conditions with all seating positions occupied in passenger cars and light trucks.

Second, the failure to require simultaneous testing of anchorages for the passenger seats in small school buses would erode the level of safety protection afforded to passengers in those small school buses. The agency based its recent decision to exempt small school buses from the requirements for rear seat lap/shoulder belts by explaining that occupants in small school buses have the occupant protection of *both* lap-only safety belts and compartmentalization; 54 FR 46257, at 46260–46261, November 2, 1989. If the anchorages for the lap belts at the passenger seating positions were now to be exempted from the simultaneous anchorage strength testing requirement, the passengers in small school buses might not have the occupant protection of lap-only safety belts in situations where all the positions on a seat were occupied. The agency believes that occupants of small school buses need the protection of *both* safety belts and compartmentalization for effective occupant protection in these lighter vehicles.

Third, NHTSA believes it is feasible and practicable for manufacturers of small school buses to design passenger seats and anchorages that can withstand simultaneous testing of anchorages under Standard No. 210 *and* exhibit the force deflection characteristics specified for compartmentalization under Standard No. 222. Engineering principles suggest that one could design the legs of the seat to sustain the anchorage strength test load, if the anchorages were mounted on the seat, and design the seat back to deform according to Standard No. 222's deflection requirements. Additionally, agency testing has confirmed that some existing van seats with anchorages mounted on the seats comply with Standard No. 210's anchorage strength requirements when all the seat-mounted anchorages were tested simultaneously.

Additionally, this rule clarifies the existing requirement for simultaneous testing for all "adjacent" designated seating positions. The term "adjacent" is imprecise. For example, "adjacent" could be misinterpreted as specifying simultaneous testing for front and rear outboard seating positions on the same side of the vehicle, or it could be misinterpreted as specifying simultaneous testing for bucket seats in the front that are not separated by a console or some other structure. This rule more precisely expresses the agency's intention by deleting the reference to simultaneous testing of "adjacent" designated seating positions, and substituting a requirement for simultaneous testing of all designated seating positions that face in the same direction and are common to the same occupant seat.

C. *Limitation on Anchorage Movement During Static Test*

The NPRM also proposed an alternative under which the static testing requirements in Standard No. 210 would be retained, but some limitations on anchorage movement during that testing would be added. For the reasons explained above in the discussion of adopting the ECE limitations on anchorage deformation, NHTSA has decided not to adopt any limitations on anchorage deformation during the testing specified in Standard No. 210. Hence, this alternative proposal for anchorage deformation limits is not adopted in this final rule.

II. *Automatic Belt Anchorage Strength*

In the NPRM, NHTSA proposed to clarify the strength requirements for anchorages for automatic belts. The agency noted that its interpretations have long stated that anchorages for automatic belts are required to meet the strength requirements set for the anchorages for manual lap/shoulder safety belts, instead of the strength requirements set for the anchorages for manual lap-only safety belts. The notice proposed to expressly incorporate this interpretation into the standard.

Several manufacturers commented that anchorages for automatic belts should be exempted from the strength requirements of Standard No. 210. NHTSA did not propose such a change, because NHTSA does not believe such a change would advance the interests of safety. For the same reasons set forth above in explaining why this rule does not exempt from the strength requirements the anchorages for dynamically tested manual belts, the agency believes it would be similarly inappropriate to exempt the anchorages for automatic belts from the strength requirements of Standard No. 210. As proposed, the specific strength requirements adopted in this rule for automatic belt anchorages are the same requirements that currently apply to anchorages for manual lap/shoulder safety belts.

III. *Deletion of Manual Belt Anchorages for Automatic Belt Vehicles*

Section S4.1.1 of Standard No. 210 currently requires anchorages for manual lap/shoulder safety belts to be installed for all front outboard seating positions in passenger cars. Section S4.1.4 of Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208), requires that front outboard seating positions in passenger cars manufactured on or after September 1, 1989 be equipped with automatic crash protection. (The front outboard passenger's seating position in these cars may be equipped with a dynamically tested manual lap/shoulder safety belt if the driver's position is equipped with an air bag and the car is manufactured before September 1, 1993.) NHTSA has expressly exempted the anchor-

ages for automatic or dynamically tested manual safety belts from the anchorage location requirements in Standard No. 210. Thus, the anchorages to which automatic or dynamically tested manual safety belts originally installed in a vehicle are attached are not required to comply with the location requirements of Standard No. 210.

However, if the anchorages for any automatic or dynamically tested manual safety belts originally installed at front outboard seating positions in a passenger car do not comply with the location requirements of Standard No. 210, the standard provides that anchorages for a manual lap/shoulder belt that comply with the anchorage location requirements must also be installed at that seating position. NHTSA justified this requirement for seemingly redundant anchorages by explaining that this requirement would allow owners to replace damaged automatic belts with manual lap/shoulder belts if they so desired.

The agency reexamined this requirement in response to a petition for rulemaking on this subject submitted by GM. This reexamination led the agency to propose to delete the requirement for complying anchorages to be provided at seating positions originally equipped with safety belts that did not make use of anchorages within the locations permitted in Standard No. 210 (i.e., automatic or dynamically tested manual safety belts). This proposal reflected the agency's tentative conclusions that:

a. NHTSA is unaware of any widespread demand for alternative types of belt systems when replacing damaged safety belts. Instead, the agency anticipates that consumers would opt to simply have a replacement safety belt system installed similar to the belt system with which the car was originally equipped. Hence, the potential benefits of a requirement for redundant anchorages would accrue very infrequently, if ever.

b. It is possible that a manual lap/shoulder safety belt would not provide adequate occupant protection at a seating position originally equipped with automatic or dynamically tested manual safety belts. For instance, the manufacturer might install an automatic or dynamically tested manual belt system that had particular elongation patterns or limited webbing spoolout, so as to adapt the safety belt system to the needs of that particular seating position. A manual lap/shoulder belt that complied with the general requirements of Standard No. 209 might not have the same attributes as the original belt system. In this case, use of a different type of belt system than that with which the vehicle was originally equipped could lessen the crash protection afforded to occupants of the car.

The NPRM took care to emphasize that this proposal would not affect the requirement in section S7 of Standard No. 210 that anchorages for a manual lap belt must be installed at the front right seating position if the automatic crash protection system cannot be used to secure a child seat and if a manual lap-only or lap/shoulder belt is not installed at that seating position. In those instances, anchorages for a manual lap belt ensure that a child seat can be properly secured at the right front seating position. NHTSA did not propose to amend that requirement.

All of the commenters that addressed this issue supported the proposed deletion of the requirement for redundant anchorages. This final rule adopts the proposed deletion of the requirement for those redundant anchorages. Additionally, since this relieves an obligation that requires vehicles to have unnecessary equipment that might result in lesser occupant protection, NHTSA finds for good cause that this deletion should be effective immediately upon publication of this rule in the *Federal Register*.

IV. *Test Anchorage With Seat in Its Rearmost Position*

Mercedes Benz filed a petition asking the agency to revise the seat location requirement currently specified to determine if the upper anchorage for a lap/shoulder safety belt complies with the anchorage location requirements of Standard No. 210. The standard currently provides that the determination will be made with the seat in its full rearward and downward position and with a two-dimensional manikin positioned with its torso line at the same angle from the vertical as the seat back and with its "H" point located at the seating reference point. (The "H" point simulates the location of the hip joint, and the seating reference point is the manufacturer's design reference point that determines the rearmost normal driving position of the seat.) Mercedes' petition asserted that vehicles with extended seat track travel would have a seating reference point several inches forward of the seat back of an adjustable seat adjusted to its rearmost position.

Mercedes filed another petition asking the agency to revise the definition of "seating reference point" in 49 CFR 571.3. This petition and the effects that a revision of the definition of "seating reference point" would have on compliance with the safety standards other than Standard No. 210 are being addressed in a separate rulemaking action. *See* 51 FR 20536; June 5, 1986.

Both in that separate rulemaking action and in the NPRM for this rule, NHTSA explained that the agency believes that positioning of the seat for the purposes of determining a vehicle's compliance with the upper anchorage location requirements of Standard No. 210 should be treated differently than the

positioning of the seat for other standards or the positioning of the seat to determine a vehicle's compliance with the minimum and maximum lap belt mounting angles. As explained above, NHTSA wants to ensure that the upper anchorage of a lap/shoulder belt cannot be positioned significantly in front of an occupant's shoulder, because such a positioning could allow increased head movement and increased risk of injury. To ensure that upper anchorages will not be positioned significantly forward of an occupant's shoulder, NHTSA believes it is appropriate to adjust the seat to its most rearward position to determine if the vehicle complies with the upper anchorage location zones specified in Standard No. 210.

In the NPRM for this rule, NHTSA stated that it would use the "existing seating reference point" to determine whether a lap belt or the lap belt portion of a lap/shoulder belt meets the minimum and maximum mounting angle requirements in Standard No. 210. The NPRM acknowledged that the seating adjustment position in which the existing seating reference point is determined "may not be the rearmost position." If the seating reference point is defined with the seat in some position other than the rearmost, the current requirement in S4.3.2 of Standard No. 210 for determining compliance with the upper anchorage location requirements (the seat in its full rearward position *and* the manikin's "H" point at the seating reference point) appears to allow the upper anchorage to be positioned significantly forward of an occupant's shoulder, notwithstanding NHTSA's repeated statements that it wants to prohibit such anchorage locations.

The reason for this apparent anomaly is that the seating reference point simultaneously defines two dependent variables. These variables are:

1. the adjustment position of the seat (rearmost *normal* driving or riding position), *and*

2. the location of the manikin's "H" point relative to the seat cushion and the seat back.

The anomaly in Standard No. 210 arises because the standard attempts to use the seating reference point to define only one of these variables (the location of the manikin's H point), and to establish a definition for the other variable different than that which is specified for the seating reference point (the adjustment position of the seat). Specifically, section S4.3.2 of Standard No. 210 refers to the seating reference point as the location for the manikin's "H" point, while specifying a seat adjustment position (full rearward and downward position) different from that which is specified for the seating reference point.

In those vehicles in which the seating reference point is determined when the seat is adjusted to a position *forward* of the rearmost seat adjustment position, the seating reference point would be located several inches forward of where the seat back would be located when the seat is in the rearmost position. When the procedures of Standard No. 210 for positioning the two dimensional manikin with its torso line at the same angle from the vertical as the seat back and its "H" point located at the seating reference point are followed for such vehicles, the result is that the manikin's torso line is located not tangent to, but several inches *forward* of and parallel to the seat back. The acceptable upper anchorage location zone shown in Figure 1 of Standard No. 210 would also move forward several inches to correspond to this manikin positioning. While the resulting anchorage location would be suitable when the seat is adjusted so that it is at or forward of the seating adjustment position in which the seating reference point was determined, the location might be unsuitable when the seat is adjusted so that it is to the rear of that seating adjustment position.

To eliminate the potential for confusion, this rule deletes the existing requirement in S4.3.2 that the manikin's "H" point be located at the seating reference point. As proposed in the NPRM, this rule substitutes a requirement that the manikin's "H" point shall be at the "design H point of the seat in that seating position, as defined in SAE Recommended Practice J1100 (June 1984)." Unlike the seating reference point approach which establishes the location of the manikin's "H" point at only one seat adjustment position, the "design 'H' point" approach can be used to establish the location of the manikin's "H" point at *any* seat adjustment position. Section S4.3.2 continues to specify the same seat adjustment position, i.e., the seat must be in the full rearward and downward position.

V. *Compliance Test Equipment*

The NPRM described the Standard No. 210 compliance testing problems the agency had experienced. NHTSA stated that the problems resulted mainly from excessive side loads induced by the body block used in the test procedure to simulate the human torso. However, other problems were attributed to belt webbing elongation, deformation of the vehicle structure, and lack of adequate distance to pull the body block in smaller vehicles. NHTSA proposed some changes specifically to address these testing problems.

A. *Use of Cables*

At present, Standard No. 210 implies that the safety belt assemblies installed in the vehicle will be used during compliance testing to transfer the test load from the body block to the anchorage. To reduce testing problems that result from the interaction between the safety belts and the test equipment, the

agency proposed to use cables (wire rope) instead of the vehicle's safety belts for compliance testing. Before proposing this change, NHTSA conducted a test program showing that Standard No. 210 compliance testing results using cables were comparable to the testing results obtained using the vehicle's safety belts.

Nearly all of the commenters that addressed this proposal opposed a change to the exclusive use of cables instead of safety belt webbing. Some commenters alleged that cables would concentrate the specified loading over a much smaller area than would occur if the loading were applied by the webbing of the safety belt installed in the vehicle. Because of this concentrated loading, these commenters alleged that loading imposed by means of cables would be so unrepresentative of loading imposed by safety belt webbing that cables should not be used for compliance testing. Other commenters, including Mercedes, suggested that the proposed use of cable instead of webbing would have only minor effects on the test results. However, these commenters suggested that the standard should permit the optional use of either cables or safety belt webbing for compliance testing. Further, some other commenters, including Chrysler, suggested that the agency could achieve its aim of reducing the number of compliance tests that cannot be completed without introducing the more concentrated loading that would result from the use of cable. These commenters recommended that Standard No. 210 specify the use of high-strength, low-elongation safety belt webbing for its compliance tests.

NHTSA was aware that connecting the cables directly to the anchorage being tested could produce loading on the anchorages that might be unrepresentative of loading that would result if the same force levels were applied to the anchorages by means of webbing. The proposal was not intended to result in compliance testing where the cables would be connected directly to the anchorage fixture. Instead, NHTSA intended to use an adapter plate to connect the cables to either the attachment hardware or the webbing of the belt system installed in the vehicle. This adapter plate would have the same geometry as a D-Ring on a belt system, and would have distributed the load evenly across the width of the webbing or the attachment hardware. The agency believes that the commenters' assertion of unrepresentative loading was based upon a misunderstanding of the proposal.

The proposal to use cables for compliance testing was intended to ensure that the results of those tests would be determined by the properties of the anchorage fixtures being tested, and that those tests would not have to be terminated before completion because of the properties of the safety belt systems installed in the vehicles. This intent can be effectuated by substituting any high-strength, low-elongation material for the webbing of the vehicle's safety belts in situations where prior experience indicates that the original equipment belt webbing will fail during compliance testing. NHTSA is using the term "high strength" to refer to any material that is stronger than the maximum load imposed during the compliance test. The term "low elongation" means a material that has no more stretch over the range of loads specified in compliance testing than typical original equipment polyester safety belt webbing. Typical polyester belt webbing has a breaking strength of approximately 7,000 pounds and an elongation of seven percent when subjected to a 2,500 pound load. NHTSA does not believe that cables would better serve the agency's purposes than any other high-strength, low-elongation material, such as chains or polyester belt webbing. Similarly, NHTSA believes that any high-strength, low-elongation material will produce comparable test results to the results that would be obtained using cables.

The agency agrees with the commenters that compliance testing should not result in unrealistic loading for the anchorages. To ensure realistic loading of the anchorages, the NPRM proposed to expressly provide in Standard No. 210 that the load would be transmitted to the anchorages by means of the original equipment safety belt attachment hardware in the vehicle. This proposal was intended to ensure that the anchorage loading during compliance testing would be identical to that which would be experienced by the anchorages if the compliance testing were conducted with the original equipment safety belt system in its entirety. To further ensure that the loading imposed during compliance testing is a realistic simulation of actual anchorage loading, this rule specifies that the material used to apply the load to the anchorages in compliance testing, whether it be cables, chains, or webbing, be equal to or greater in strength than the original equipment webbing and that the material used to apply the load to the anchorages shall duplicate the geometry of the original equipment webbing at that seating position.

B. *Test Block Width*

Standard No. 210 currently specifies that a body block 20 inches long by 14 inches wide shall be used in compliance testing for lap belt anchorages and the pelvic portion of lap/shoulder belt anchorages. The NPRM noted that the 14 inch width of the current body block can preclude the simultaneous testing of safety belt anchorages for all three seating positions in the rear seat of smaller cars. To address this problem, the NPRM proposed to reduce the body block's dimensions to 13 inches long by 10 inches wide. The proposed width reduction was intended to

make it easier to simultaneously test anchorages for rear seating positions in smaller cars. The proposed length reduction was intended to provide more total pull distance in both front and rear seats, thereby making it easier to conduct the strength tests. NHTSA acknowledged that the proposed reduction in the size of the body blocks would result in a very small reduction in the longitudinal load applied to the anchorage. However, the agency noted that the overall load input would be unchanged.

Nearly all of the commenters that addressed this proposed reduction in the size of the body block opposed the change. Only BMW commented that it had no objection to this proposal, although that commenter suggested that the use of the smaller body blocks be made optional with the manufacturer. The other commenters raised various objections to the proposal.

First, many commenters argued that the smaller body blocks would move Standard No. 210 away from harmonization with the ECE regulation, which uses 20 inch by 16 inch body blocks for its lap belt anchorage testing. This argument was not persuasive. Standard No. 210 currently specifies that 14 inch wide body blocks will be used in compliance testing. This requirement is not harmonized with the ECE regulation's specification of 16 inch wide body blocks. It does not appear feasible to move Standard No. 210 toward the wider body blocks used by the ECE, considering the testing problems that have been encountered with the current body blocks that are already narrower than the ECE body blocks. The proposed reduction in size to even narrower 10 inch wide body blocks would remain not harmonized with the ECE 16 inch wide body blocks, but would reduce the testing problems encountered with the current 14 inch wide body blocks. Thus, the current and proposed absence of harmonization between Standard No. 210 and the ECE regulation is not unnecessary nor is it an oversight. Instead, it reflects actual problems that have arisen in compliance testing.

Second, many commenters argued that the smaller body bock would produce unrealistic loading on the anchorages. The reduction in width of the body block will cause the load to be applied in a direction that is five to ten degrees further away from directly forward of the anchorage. NHTSA agrees that, as the angle of the force application deviates from the directly forward direction, an actual increase in the resultant vector in the direction of the force applied will be created. This means that the anchorages being tested will experience slightly higher forces as less wide body blocks are used to apply the forces, even though the overall force remains constant.

However, NHTSA does not believe these slightly higher forces are significant enough to produce differing test results. The 10 inch wide body bocks would produce forces on the lap belt anchorages during compliance testing that are approximately two percent greater than would be imposed on those anchorages by using 14 inch wide body blocks during compliance testing. Although commenters asserted that this increase could force redesign of the anchorages in some vehicles, no commenter offered any examples of particular vehicles whose anchorages would have to be redesigned.

Additionally, NHTSA does not believe that the reduced body block size is unrepresentative of potential vehicle occupants, since many children have a pelvic width of 10 inches or less. For instance, the hip breadth of a sitting 50th percentile 6-year-old child is 8.4 inches. The hip breadth of a sitting 5th percentile adult female is 12.8 inches. Given these facts, the argument that the 10 inch wide body block would be unrepresentative of persons likely to occupy the seating position is not convincing.

Third, several commenters questioned the need for smaller body blocks for various reasons. Some commenters, including Mitsubishi, asserted that they had not encountered any difficulties in conducting certification testing in the rear seats of even their subcompacts using the procedures currently specified in Standard No. 210. Such assertions are contrary to the agency's experience, because NHTSA has encountered difficulties conducting compliance testing in the rear seat of smaller cars, as stated in the NPRM. The agency believes it must make some changes to the compliance testing procedures set forth in the standard to minimize difficulties in such testing, regardless of the manufacturers' experiences during their certification testing of their particular models.

Other commenters, including Ford, asserted that the compliance testing problems that led the agency to propose the use of smaller body blocks would be alleviated by other changes proposed in the NPRM. It was asserted that, when these other changes were adopted, there would be no further need for the smaller body blocks in compliance testing. In response to these allegations, the agency has analyzed this rule and concluded that there may still be instances where the smaller body blocks will be needed, but those instances will be less frequent. Accordingly, this rule adopts a provision permitting the use of the smaller body blocks.

Even though NHTSA has concluded that the arguments set forth in the comments are not persuasive reasons for *prohibiting* the use of smaller body blocks in compliance testing, the agency is reluctant to *require* the use of smaller body blocks in the face of these arguments. The reason for proposing to use smaller body blocks was solely to reduce compliance testing

problems. The smaller body blocks were not intended to address any specific safety concerns or otherwise impose more stringent testing requirements. To the extent that the smaller body blocks impose more stringent requirements, even if the increase in stringency is insignificant, this is unintended.

This final rule includes two additional provisions to ensure that no unintended impacts will result from the use of smaller body blocks. First, the smaller body block will be used only in the center seating position(s) of three or more simultaneously tested sets of anchorages. This will ensure that the smaller body block is used only when it might be necessary to do so. Second, the use of the smaller body block at the center seating positions will be at the option of the vehicle manufacturer. This will ensure that the smaller body block is used for testing only when the vehicle manufacturer chooses to specify the use of the smaller body block. These two new provisions allow the agency to ensure that no additional burdens will be imposed on any party as a result of the use of smaller body blocks.

VI. *Clarification of Compliance Failure*

In the agency's compliance testing for Standard No. 210, there have been instances in which the safety belt attachment hardware or attachment bolts have broken before the maximum test load had been applied to the anchorage. However, the agency's ability to take effective corrective action was hindered by the fact that it is not clear under the existing language of Standard No. 210 that such failures are noncompliances with the standard, since the standard sets performance requirements for anchorages.

The agency tentatively concluded that it was necessary to amend Standard No. 210 to assure the proper performance not only of the anchorage fixture, but also of the belt assembly attachment hardware and bolts. The strength requirements of Standard No. 210 were intended to ensure that the safety belt system will remain attached to the vehicle and not break free, even when exposed to severe crash forces. Obviously, the safety belt system will *not* remain attached to the vehicle if the anchorage fixture successfully withstands the crash forces, but the hardware attaching the belt system to the anchorage fixture fails when exposed to these crash forces.

Accordingly, the NPRM proposed to amend Standard No. 210 to explicitly provide that the attachment hardware, the attachment bolt, and the anchorage fixture itself must all comply with the performance requirements for anchorage strength.

Most of the commenters that addressed this proposal opposed it. The most frequently stated reason for opposing this change was that Standard No. 209, *Seat Belt Assemblies,* already establishes performance requirements for the strength of anchorage hardware.

One of the commenters asked if NHTSA was using the term "attachment hardware" in this proposal to mean the same thing that this term means when used in Standard No. 209. Section S3 of Standard No. 209 defines attachment hardware as "any or all hardware designed for securing the webbing of a seat belt assembly to a motor vehicle." The answer to this question is yes, "attachment hardware" is used with the same meaning in Standards No. 209 and 210.

This commenter and others suggested that it was unnecessary to impose a second strength requirement on the attachment hardware. NHTSA did not find these comments persuasive. As explained earlier in this preamble, the test conditions in Standard No. 210 are not intended to simulate an actual vehicle crash. Instead, the test conditions in Standard No. 210 are intended to subject the safety equipment to force or exposure levels that are sufficiently high that one can reasonably conclude that the equipment is unlikely to fail as a result of exposure to severe crash forces or severe environmental conditions. NHTSA believes it is important to expose both the anchorage itself and the connection(s) between that anchorage and the safety belt assembly, including the connection between the attachment hardware and the anchorage, to these high force levels. Such exposure indicates that the safety belt system will remain attached to the anchorage when exposed to crash forces. Although requiring the attachment hardware to be tested under Standard No. 210 may appear redundant of the existing requirement that the attachment hardware comply with the requirements of Standard No. 209, these tests actually demonstrate a continuum of strength necessary for occupant protection. Accordingly, S5 of Standard No. 210 is amended to explicitly provide that the attachment hardware and the attachment bolt must comply with the performance requirements for anchorage strength in Standard No. 210.

VII. *Issues Not Directly Discussed in the NPRM*

A. *Vehicles with a GVWR in Excess of 10,000 Pounds*

Several commenters asked that the agency consider harmonizing the anchorage strength requirements more fully with the ECE regulations as applied to heavy vehicles (those with a gross vehicle weight rating [GVWR] of more than 10,000 pounds). The commenters noted that ECE Regulation No. 14 permits the anchorages on heavy vehicles to be subjected to forces during strength testing that are one-half of the forces to which the anchorages on passenger cars are subjected. The justification for

this reduction in force for heavy vehicle anchorages is that, in a crash situation, the greater mass of these heavy vehicles will result in deceleration at a much slower rate than that of smaller vehicles, which in turn will subject the vehicle occupant and the vehicle safety belt assemblies and anchorages to lesser crash forces.

NHTSA agrees that the loads experienced by the anchorages in heavy vehicles during crashes are generally less than the loads experienced by lighter vehicles during similar crashes. However, the questions of whether to establish different loading requirements during the strength test for anchorages in heavy vehicles, and, if so, what different requirements are appropriate, were not within the scope of this rulemaking. The agency is currently examining the question of the appropriate compliance test levels for heavy vehicles, including the safety belt anchorages in those vehicles. NHTSA will address this topic in a later rulemaking action devoted to this topic.

Further, several commenters raised questions about seat adjusters on pedestal seats in heavy vehicles (i.e., seats that include a suspension system and that are mounted on a pedestal-like structure). Flxible correctly stated in its comments that Standard No. 210's anchorage strength test requires that the seat be in its rearmost position. According to this commenter, many suspension systems on heavy vehicle seats allow seat movement in both the vertical and horizontal directions. For most designs of seats with suspension systems, a tether strap is used to connect the movable part of the seat to the vehicle structure. This tether strap is designed to be slack at all times to allow the movable part of the seat to move freely in both the vertical and horizontal directions. In order to put the seat in its rearmost position to test the anchorage strength, the tether must be adjusted to be taut so that the seat does not move horizontally to some position forward of its rearmost position. Flxible commented that while this allows the agency to test suspension seats in the same way as it tests seats without a suspension system, it also results in testing suspension seats and safety belt anchorages in a way that is totally artificial and not representative of how that seat and anchorage would react in a real vehicle crash situation.

Again, this concern is outside the scope of this rulemaking action. However, Standard No. 210 compliance testing is conducted simultaneously with the compliance testing for Standard No. 207, *Seating Systems*. In an August 3, 1988 letter to Mr. Barry Nudd, the agency explained in detail the procedures it uses for Standard No. 207 compliance testing of pedestal seats with seat adjusters that are installed in heavy vehicles. The agency promised in the Nudd letter to initiate rulemaking on Standard No. 207's requirements for pedestal-type seats. As a part of that rulemaking, NHTSA will also address the appropriateness of the existing requirements in Standard No. 210 for pedestal-type seats.

B. *Leadtime*

The agency proposed to make these changes effective very soon after publication of a final rule, because the agency believed that the changes would just simplify the compliance test procedures and promote the international harmonization of vehicle safety requirements. NHTSA did not believe that any design changes would have to be made to existing vehicles in response to this rule. Accordingly, the agency believed that the only leadtime that would be needed would be the time to institute changes in the compliance test procedures.

However, many commenters argued that these agency beliefs were incorrect. Several commenters stated that some vehicle models would have to be redesigned in response to this rule, and that the redesign would require more time than was proposed in the NPRM. The leadtime said to be necessary to accommodate the redesigns ranged from 18 months, in the comments of Mazda and Subaru, to 4 years, in the comments of Nissan and Toyota. The agency was persuaded by these comments that more leadtime is necessary, especially since some modifications of existing designs may be needed as a result of the amendment to the minimum lap belt mounting angle incorporated in this rule. Therefore, this rule will not become effective until September 1, 1992. The agency has concluded that this period of leadtime will allow manufacturers to make the necessary changes without imposing an unnecessary burden.

Economic and Other Impacts of This Rule

NHTSA has evaluated the impacts of this final rule and determined that it is neither "major" within the meaning of Executive Order 12291 nor "significant" within the meaning of the Department of Transportation's regulatory policies and procedures. The new requirement for a minimum lap belt angle of 30 degrees will require modifications to some current vehicles that have lap belt angles of less than 30 degrees. However, the agency believes any such modifications that are necessary for current vehicles do not require any extensive redesign of the vehicle. These modifications can be made with minimal costs and burdens as a part of the minor changes that are routinely made to vehicles between model years. Since this rule allows such modifications to be made at any time before September 1, 1992, the costs and burdens of making the modifications will be minimal. NHTSA estimates that the

costs of these modifications will average between $1.40 and $3.80 per affected vehicle.

The requirement for simultaneous testing of the anchorages for all seating positions that face in the same direction and are common to the same occupant seat could force design changes to such anchorages mounted on the seat frame, because such anchorages were not subject to the simultaneous testing requirement before the effective date of this amendment. However, testing done both by this agency and by manufacturers has shown that it is feasible to design seats for passenger cars and vans, *including* small school buses, that can withstand simultaneous testing of anchorages under Standard No. 210, testing of the seat under Standard No. 207, and testing of the seat back under Standard No. 222. While there will be some costs and burdens for the manufacturers whose vehicles are not already equipped with anchorages and seats that can comply with the simultaneous testing requirement, those costs and burdens will not be significant. Instead, those manufacturers will incur the costs that have already been voluntarily incurred by many of their competitors.

Simultaneous testing of seat mounted anchorages in small school bus seats might increase prices of those buses by between $36 and $320 per bus, for total costs of from $183,600 to $1,632,000. Because the elasticity of demand for school buses is very low, these increased prices are not anticipated to have any significant effect on school bus sales. Likewise, no significant impacts are anticipated for school bus manufacturers.

The deletion of the requirement for redundant anchorages in vehicles equipped with automatic safety belts will result in some minimal cost savings for the manufacturers of vehicles equipped with automatic safety belts. However, this savings will be minimal, since it will only reflect the materials cost of the redundant anchorages, estimated by NHTSA to be not more than $1.00 per vehicle. Since as many as 4 million passenger cars per year could avoid these costs, a total cost savings of $4 million might result from this deletion of the redundant anchorage requirements.

Considering all these factors together, NHTSA estimates that if the estimated costs and other burdens are at the high end of the range, this rule will impose a net cost increase of $411,000. If the actual costs associated with this rulemaking are at the lower end of the estimated range, a net cost savings of up to $3.3 million could be realized.

In consideration of the foregoing, 49 CFR 571.210 is amended as follows:

1. S4.1.3 of Standard No. 210 is revised to read as follows:

S4.1 *Type.*

* * *

S4.1.3 (a) Notwithstanding the requirement of S4.1.1, each vehicle manufactured on or after September 1, 1987 that is equipped with an automatic restraint at the front right outboard designated seating position, which automatic restraint cannot be used for securing a child restraint system or cannot be adjusted by the vehicle owner to secure a child restraint system solely through the use of attachment hardware installed as an item of original equipment by the vehicle manufacturer, shall have, at the manufacturer's option, either anchorages for a Type 1 seat belt assembly installed at that position or a Type 1 or Type 2 seat belt assembly installed at that position. If a manufacturer elects to install anchorages for a Type 1 seat belt assembly to comply with this requirement, those anchorages shall consist of, at a minimum, holes threaded to accept bolts that comply with S4.1(f) of Standard No. 209 (49 CFR 571.209).

(b) The requirement in S4.1.1 of this standard that seat belt anchorages for a Type 2 seat belt assembly shall be installed for each forward-facing outboard designated seating position in passenger cars does not apply to any such seating positions that are equipped with an automatic or dynamically tested manual seat belt assembly that meets the frontal crash protection requirements of S5.1 of Standard No. 208 (49 CFR 571.208).

2. S4.2 of Standard No. 210 is amended by revising S4.2.1, S4.2.2, and S4.2.4 to read as follows:

S4.2 *Strength.*

S4.2.1 Except for side-facing seats, the anchorages, attachment hardware, and attachment bolts for any of the following seat belt assemblies shall withstand a 5,000-pound force when tested in accordance with S5.1 of this standard:

(a) Type 1 seat belt assembly;

(b) Lap belt portion of either a Type 2 or automatic seat belt assembly, if such seat belt assembly is voluntarily installed at a seating position; and

(c) Lap belt portion of either a Type 2 or automatic seat belt assembly, if such seat belt assembly is equipped with a detachable upper torso belt.

S4.2.2 The anchorages, attachment hardware, and attachment bolts for all Type 2 and automatic seat belt assemblies that are installed to comply with Standard No. 208 (49 CFR 571.208) shall withstand 3,000-pound forces when tested in accordance with S5.2.

* * *

S4.2.4 The anchorages for all designated seating positions that face in the same direction and are common to the same occupant seat shall be tested by simultaneously loading those anchorages in accor-

dance with the applicable procedures set forth in S5 of this standard.

3. S4.3 of Standard No. 210 is amended by revising S4.3.1.1, S4.3.1.2, S4.3.1.3, and S4.3.2, to read as follows:

S4.3 *Location.* * * *

S4.3.1 *Seat belt anchorages for Type 1 seat belt assemblies and the pelvic portion of Type 2 seat belt assemblies.*

S4.3.1.1 In an installation in which the seat belt does not bear upon the seat frame:

(a) If the seat is a nonadjustable seat, then a line from the seating reference point to the nearest contact point of the belt with the hardware attaching it to the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

(b) If the seat is an adjustable seat, then a line from a point 2.50 inches forward of and 0.375 inches above the seating reference point to the nearest contact point of the belt with the hardware attaching it to the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

S4.3.1.2 In an installation in which the belt bears upon the seat frame, the seat belt anchorage, if not on the seat structure, shall be aft of the rearmost belt contact point on the seat frame with the seat in the rearmost position. The line from the seating reference point to the nearest belt contact point on the seat frame, with the seat positioned at the seating reference point, shall extend forward from that contact point at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

S4.3.1.3 In an installation in which the seat belt anchorage is on the seat structure, the line from the seating reference point to the nearest contact point of the belt with the hardware attaching it to the anchorage shall extend forward from that contact point at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

* * * * *

S4.3.2 *Seat belt anchorages for the upper torso portion of Type 2 seat belt assemblies.* Adjust the seat to its full rearward and downward position and adjust the seat back to its most upright position. With the seat and seat back so positioned, the seat belt anchorage for the upper end of the upper torso restraint shall be located within the acceptable range shown in Figure 1, with reference to a two-dimensional drafting template described in SAE Recommended Practice J826 (May 1987). The template's "H" point shall be at the design "H" point of the seat for its full rearward and full downward position, as defined in SAE Recommended Practice J1100 (June 1984), and the template's torso line shall be at the same angle from the vertical as the seat back.

4. S5 of Standard No. 210 is revised to read as follows:

S5 *Test procedures.* Each vehicle shall meet the requirements of S4.2 of this standard when tested according to the following procedures. Where a range of values is specified, the vehicle shall be able to meet the requirements at all points within the range. For the testing specified in these procedures, the attachment hardware (including the retractors and "D" rings) and the attachment bolts from the seat belt assembly installed at a seating position shall be used to attach to the anchorage being tested material whose breaking strength is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position. The geometry of the attachment shall duplicate the geometry of the attachment of the originally installed seat belt assembly.

S5.1 *Seats with Type 1 or Type 2 seat belt anchorages.* With the seat in its rearmost position, apply a force of 5,000 pounds in the direction in which the seat faces to a pelvic body block as described in Figure 2A, restrained by a material whose breaking strength is is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position, which material is installed so as to duplicate the geometry of any of the seat belt assemblies identified in S4.2.1 of this standard that are installed as original equipment at any designated seating positions on the seat, in a plane parallel to the longitudinal centerline of the vehicle, with an initial force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. Apply the force at the onset rate of not more than 50,000 pounds per second. Attain the 5,000 pound force in not more than 30 seconds and maintain it for 10 seconds. At the manufacturer's option, the pelvic body block described in Figure 2B may be substituted for the pelvic body block described in Figure 2A to apply the specified force to the center set(s) of anchorages for any group of three or more sets of anchorages that are simultaneously loaded in accordance with S4.2.4 of this standard.

S5.2 *Seats with Type 2 or automatic seat belt anchorages.* With the seat in its rearmost position, apply a force of 3,000 pounds in the direction in which the seat faces simultaneously to a pelvic body block, as described in Figure 2A, restrained by a material whose breaking strength is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position, which material is installed so as to duplicate the geometry of any of

the seat belt assemblies identified in S4.2.2 of this standard that are installed as original equipment at any designated seating positions on the seat, in a plane parallel to the longitudinal centerline of the vehicle, with an initial force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. Apply the forces at the onset rate of not more than 30,000 pounds per second. Attain the 3,000 pound forces in not more than 30 seconds and maintain it for 10 seconds. At the manufacturer's option, the pelvic body block described in Figure 2B may be substituted for the pelvic body block described in Figure 2A to apply the specified force to the center set(s) of anchorages for any group of three or more sets of anchorages that are simultaneously loaded in accordance with S4.2.4 of this standard at the onset rate of not more than 30,000 pounds per second. Attain the 3,000 pound forces in not more than 30 seconds and maintain them for 10 seconds.

5. The figures in Standard No. 210 are amended by revising Figure 1, redesignating Figure 2 as Figure 2A, and adding a new Figure 2B, to appear as follows:

Issued on April 18, 1990.

Jeffrey R. Miller
Deputy Administrator

55 FR 17970
April 30, 1990

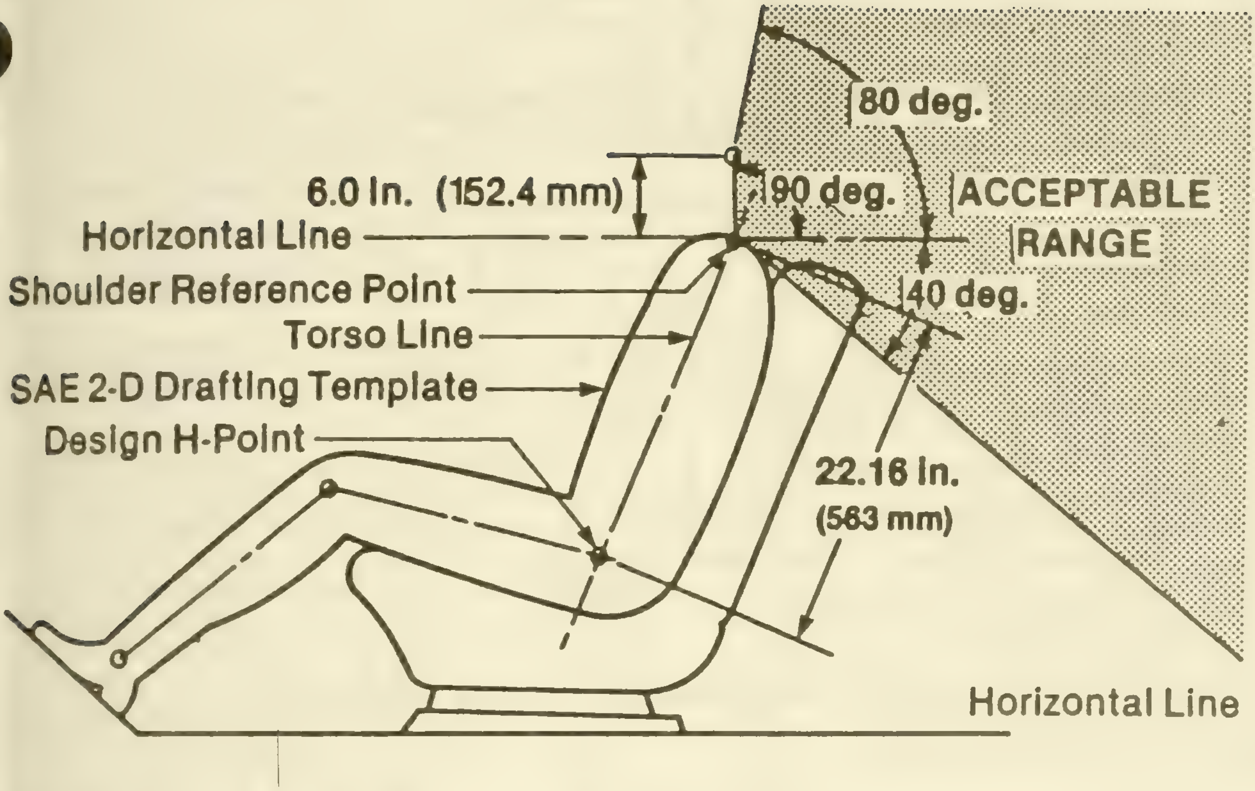


FIGURE 1 - LOCATION OF ANCHORAGE FOR UPPER TORSO RESTRAINT

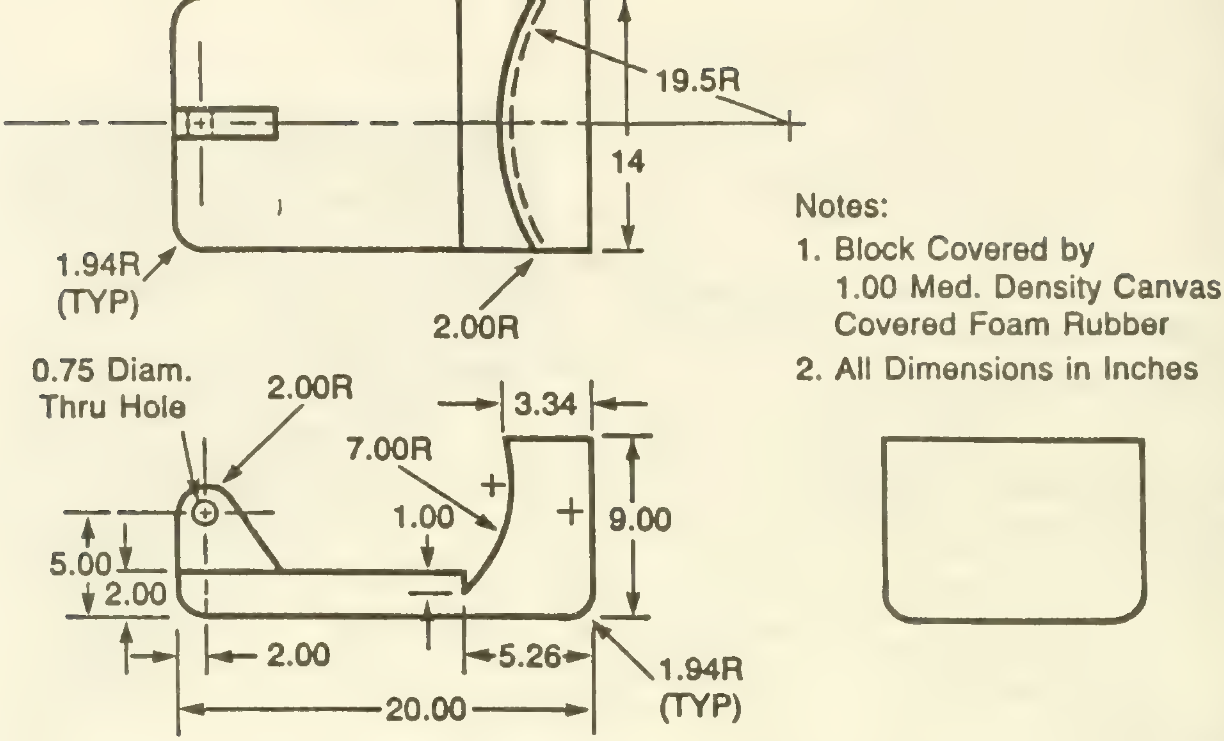


Figure 2A Body Block for Lap Belt Anchorage

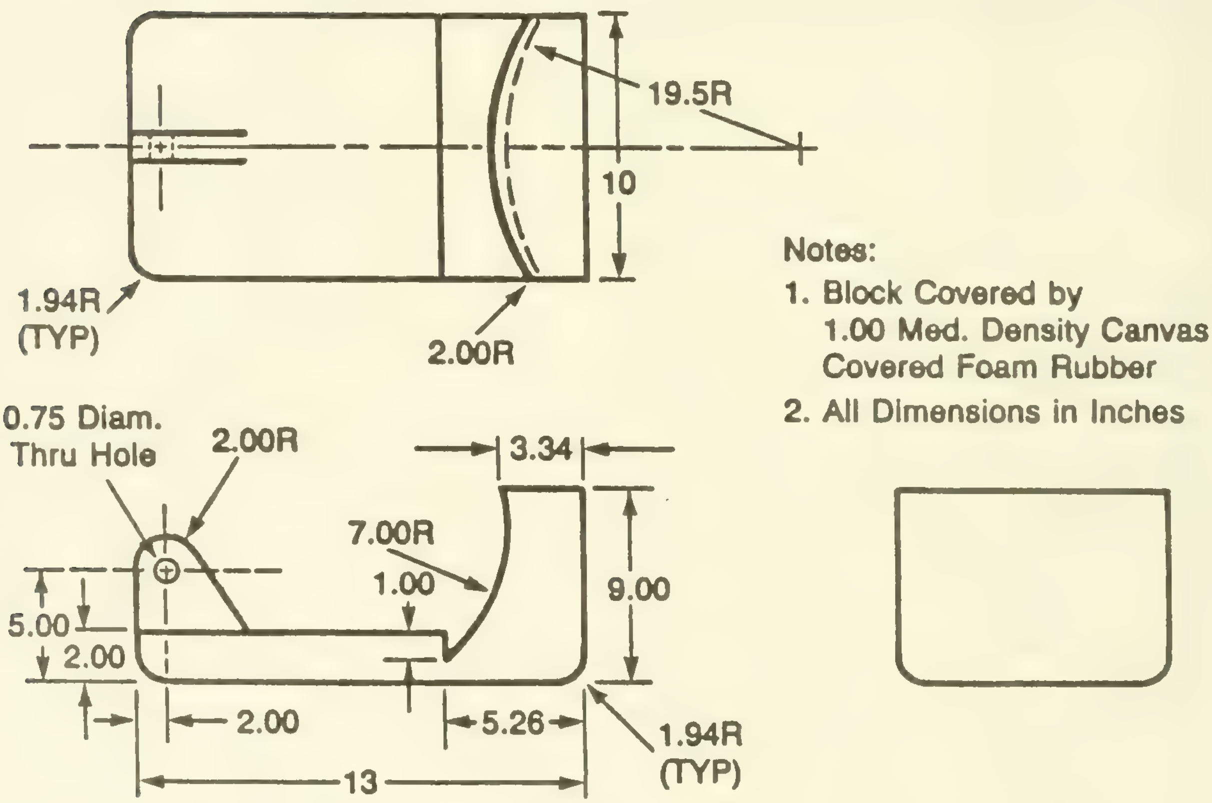


Figure 2B Optional Body Block for Center Seating Positions

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages
(Docket No. 87-02; Notice 3)

ACTION: Final rule; technical amendment.

SUMMARY: NHTSA recently published a final rule that, among other things, clarified the test procedures used to determine if seats with manual lap/shoulder safety belts or automatic safety belts comply with the anchorage strength requirements. This rule was intended to make clear that the anchorages for these safety belts are tested by simultaneously applying 3,000 pound forces to the upper torso belt and lap belt portions, using specified body blocks to apply this load, instead of by simultaneously applying a 3,000 pound force to the upper torso belt portion and a 5,000 pound force to the lap belt portion. However, NHTSA inadvertently omitted the requirements for the upper torso belt anchorages from this final rule. This notice adds language to correct this oversight.

DATES: The amendment made by this notice takes effect on September 1, 1992. This is the date on which the erroneous language in the April 30, 1990 final rule would have become effective.

SUPPLEMENTARY INFORMATION: On April 30, 1990 (55 FR 17970), NHTSA published a final rule amending Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR §571.210). Among other things, that rule clarified that the anchorages for manual lap/shoulder safety belts and automatic safety belts are tested for compliance with the anchorage strength requirements by simultaneously applying 3,000 pound forces to the upper torso and lap belt portions of the safety belt, instead of by simultaneously applying a 3,000 pound force to the upper torso belt portion and a 5,000 pound force to the lap belt portion. However, the final rule inadvertently omitted the requirement for applying the 3,000 pound force to the upper torso belt portion of the safety belt. This notice corrects that oversight.

It was clear that this omission was an oversight, because the agency proposed to apply 3,000 pound forces simultaneously to the upper torso belt portion and the lap belt portion of the safety belt and nothing in the preamble to the final rule indicated an agency intention to exempt anchorages for the upper torso belt portions of safety belts from the anchorage strength requirements. Moreover, no commenter suggested that it would be appropriate to exempt upper torso belt anchorages for manual lap/shoulder belts from the anchorage strength requirements. Hence, the agency finds for good cause that notice and opportunity for comment on this correction are unnecessary. The agency also finds that this correction should become effective on September 1, 1992, the date on which the other requirements in the April 30, 1990 final rule will become effective.

In consideration of the foregoing, 49 CFR §571.210 is amended as follows:

S5.2 of Standard No. 210 is revised to read as follows:

* * * * *

S5.2 *Seats with Type 2 or automatic seat belt anchorages.* With the seat in its rearmost position, apply forces of 3,000 pounds in the direction in which the seat faces simultaneously to a pelvic body block, as described in Figure 2A, and an upper torso body block, as described in Figure 3, restrained by a material whose breaking strength is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position, which material is installed so as to duplicate the geometry of any of the seat belt assemblies identified in S4.2.2 of this standard that are installed as original equipment at any designated seating positions on the seat, in a plane parallel to the longitudinal centerline of the vehicle, with an initial force application angle of not less than 5 degrees more than 15 degrees above the horizontal. Apply the forces at the onset rate of not more than 30,000 pounds per second. Attain the 3,000 pound forces in not more than 30 seconds and maintain it for 10 seconds. At the manufacturer's option, the pelvic body block described in Figure 2B may be substituted for the pelvic body block described in Figure 2A to apply the specified force to

the center set(s) of anchorages for any group of three or more sets of anchorages that are simultaneously loaded in accordance with S4.2.4 of this standard.

* * * * *

Issued on June 12, 1990.

Jeffrey R. Miller
Deputy Administrator

55 FR 24240
June 15, 1990

PREAMBLE TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210

Seat Belt Assembly Anchorages
(Docket No. 90-26; Notice 2)
RIN: 2127-AD44

ACTION: Final rule.

SUMMARY: This rule amends Standard No. 210, Seat Belt Assembly Anchorages, to clarify the definition of "seat belt anchorage." The amended definition explicitly states that any vehicle part or component that transfers the load from a safety belt to the vehicle structure is part of the anchorage. This amendment will ensure that the safety belt system remains attached to the vehicle, even when exposed to severe crash forces.

DATES: The amendments made in this rule are effective September 1, 1992.

SUPPLEMENTARY INFORMATION: Federal Motor Vehicle Safety Standard No. 210, Seat Belt Assembly Anchorages, specifies performance requirements for safety belt anchorages to reduce the likelihood of the anchorage's failure in a crash. The requirements, which apply to passenger cars, trucks, buses, and multipurpose passenger vehicles, specify the forces that an anchorage must be capable of withstanding during a static strength test.

On October 31, 1990, the agency published a notice of proposed rulemaking (NPRM) proposing to amend the definition of "seat belt anchorage" in Standard No. 210. This notice was initiated in response to questions about the scope of Standard No. 210 that had arisen during the agency's compliance tests, for example, instances when vehicle seats had separated from the vehicle floor when testing seat-mounted anchorages before the required loads were reached. Since Standard No. 210 is intended to ensure that the safety belt remains attached to the vehicle, the agency proposed a new definition intending to clarify the scope of Standard No. 210. The proposed definition was:

> Seat belt anchorage means any component, other than the safety belt webbing, involved in transferring seat belt assembly loads to the vehicle structure, including, but not limited to, the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure.

NHTSA received 12 comments in response to this NPRM. The commenters included seat, seat belt, and vehicle manufacturers, a private citizen, and a state government. All comments were considered while formulating this final rule and the most significant comments are addressed below.

Attachment hardware. Seven commenters, the Automotive Occupant Restraints Council [AORC], Chrysler Corp. [Chrysler], Ford Motor Company [Ford], General Motors Corp. [GM], Mitsubishi Motors Corp. [Mitsubishi], Navistar International Transportation Corp. [Navistar], and Volkswagen of America, Inc. [VW], objected to the inclusion of attachment hardware in the definition. Various reasons were given for these objections. Ford, GM, Mitsubishi, and VH stated that testing attachment hardware under Standard No. 210 was redundant because it is already tested under Standard No. 209, Seat Belt Assemblies. Ford, GM, and Mitsubishi stated that the agency had not demonstrated a safety need to test attachment hardware under Standard No. 210. AORC, Mitsubishi, Ford, and VW believe that Standard No. 210 compliance tests should be conducted by replacing the original attachment hardware with fixtures that duplicate their geometry, if the tests cannot be completed due to failures of the attachment hardware before the required loads are reached. Mitsubishi objected because the loading of the attachment hardware during the Standard No. 210 test was different from the loading during an actual crash or the loading during the Standard No. 209 test. Finally, AORC objected to the inclusion of attachment hardware because this would require cooperation between the seat belt manufacturer and the vehicle manufacturer.

On April 30, 1990, the agency published a final rule which, among other things, extended the applicability of Standard No. 210 to the attachment hardware of a safety belt system (55 FR 17970). The agency received three petitions for reconsideration opposing this aspect of the final rule. Elsewhere in today's edition of the *Federal Register* the agency has published a response to those petitions for reconsideration.

As explained in that response, the agency agreed with the petitioners that the static performance requirements of Standard No. 210 were unnecessarily redundant for the attachment hardware of automatic safety belt systems and for the attachment hardware of dynamically tested manual safety belt systems which are the only occupant restraint at a seating position. To reflect this position, that response to the petitions for reconsideration excludes the attachment hardware for these safety belt systems from the requirements of S4.1.1 and S4.1.2 of Standard No. 210. It should be noted that, as further explained in that notice, the agency does not consider a manual belt installed at a seating position that is also equipped with an air bag to be dynamically tested.

The agency disagrees with those commenters that asserted that the requirement to test attachment hardware for manual belts that are not dynamically tested under Standard No. 210 is redundant. The agency also disagrees that there is no safety need to test attachment hardware under Standard No. 210. Attachment hardware plays an integral part in the transfer of safety belt loads to the vehicle structure. The strength conditions in Standard No. 210 are intended to subject the vehicle anchorage to force levels that are sufficiently high that one can be reasonably certain that the safety belt will remain attached to the vehicle structure even when exposed to severe crash conditions. If the attachment hardware were not subjected to those same force levels, during the Standard No. 210 strength test, the test would be less useful. A belted occupant will not be well protected in a crash if the attachment hardware breaks, but the rest of the anchorage withstands the crash loading. To minimize the chances of the attachment hardware breaking during a crash, this rule adopts a requirement that attachment hardware for non-dynamically-tested manual belts be subject to the strength test in Standard No. 210.

In addition, the agency continues to believe that original attachment hardware should be used during Standard No. 210 compliance tests for the anchorages for all safety belt systems, including those excluded from the requirements of S4.1.1 and S4.1.2, in order to ensure that the load application onto the anchorage is as realistic as possible. The agency has considered conducting the compliance tests using replacement fixtures which duplicate the geometry. However, the agency is concerned that developing a fixture which would accurately simulate every attachment would be very difficult. The agency cannot justify devoting the time necessary to solve this difficult problem, because such a fixture would still be less representative than the particular attachment hardware in the vehicle being tested.

The agency also was not persuaded by those commenters who stated that the loading for the Standard No. 210 test was different than the loading experience in either an actual crash or the Standard No. 209 test. The agency has already explained at length that Standard No. 210's strength test is not intended to simulate an actual crash condition, but is instead intended to be severe enough to ensure that the anchorage is unlikely to fail in an actual crash, even a very severe crash. For a detailed explanation of this, see 55 FR 17970, at 17972-17973; April 30, 1990. Thus, NHTSA does not consider it a telling point to assert that loading for the Standard No. 210 strength test is more severe than loading in a typical crash.

The agency is also not persuaded by the assertions that Standard No. 210's loading is different from that in Standard No. 209. This is true and it reflects the different purposes of these two standards. Standard No. 209 is intended to measure the performance of seat belt assemblies as separate pieces of equipment. Standard No. 209 assesses the performance of the attachment hardware only as a part of the seat belt assembly.

Standard No. 210, however, is a broader assessment of vehicle performance. It focuses not on any individual item of equipment or individual component. Instead, the strength test of Standard No. 210 is intended to assess the strength of the attachment of the seat belt assembly to the vehicle, in order to ensure that the belt will remain attached to the vehicle even when exposed to severe crash conditions. NHTSA believes it is appropriate to measure the performance of the attachment hardware at the particular seating position in the particular vehicle in which it is installed for the purposes of Standard No. 210. as well as the generic performance of the attachment hardware pursuant to Standard No. 209.

Finally, the agency is aware that the inclusion of attachment hardware in Standard No. 210 may require greater coordination between the vehicle manufacturer and the safety belt system manufacturer. This was partially the intent of this requirement. From a regulatory standpoint, the burden of certifying compliance with Standard No. 210 is entirely on the vehicle manufacturer, not the safety belt manufacturer. However, the agency believes that, since the safety belt system is to become an integral part of the vehicle, there will be interaction between the safety belt system manufacturer and the vehicle manufacturer to ensure that the restraint will perform as intended.

For the above reasons, the agency has retained attachment hardware within the definition of "seat belt anchorage." The agency notes that the definition proposed in the NPRM included the phrase "seat belt assembly loads." Since "seat belt assembly" is defined differently in Standard No. 209 than was intended here, the agency has substituted the term "seat belt loads" in the final rule to avoid any possibility of confusion.

Alternate Definitions.

Two commenters, a private citizen and GM, stated that the proposed definition was more ambiguous than the existing one. Phrases that were considered ambiguous include; "including, but not limited to," "any part of the vehicle structure," and "attachment hardware."

The agency disagrees with the commenters that these phrases make the definition more ambiguous. The new definition gives examples of some of the components whose failure would result in non-compliance with Standard No. 210, without limiting the scope of the definition to those enumerated components. This new definition will mean that the failure of any component, other than the safety belt itself during Standard No. 210 compliance testing will be considered an apparent non-compliance with the standard.

Americans with Disabilities Act.

One commenter, a private citizen, stated that the proposed rulemaking may conflict with the requirement to provide accessible vehicles under the Americans with Disabilities Act of 1990 (P.L. 101-336, 42 U.S.C. 12101, et seq). The commenter stated that the requirements should not apply to vehicles equipped with custom or special seating for the disabled. The agency has not excluded such seating from the requirements of this rule. The commenter did not submit any information suggesting that it was not feasible for such seating to comply with the requirements of this rule. Without information that compliance is not feasible, the agency believes that customized seating for the disabled should provide the same level of occupant protection as is provided by standard seating.

Another commenter, a state government, supported the inclusion of the seat structure and pedestal in the anchorage definition. This state has required safety belts for specialized seating installed for the disabled to be anchored directly to the vehicle, rather than to the seat, based upon experience with the lack of strength of these seats. Under the new definition of "seat belt anchorage," this state would no longer have to retain this requirement since, if a safety belt were anchored to the seat, the seat and its pedestal would be considered part of the anchorage and therefore, subject to the strength requirements of Standard No. 210.

Location Requirements.

Four commenters (Ford, Mitsubishi, VW, and Volvo Cars of North America [Volvo]) pointed out that the term "seat belt anchorage" is used in two contexts in Standard No. 210. First, it is used in S4.2 to identify the scope of the standard for performance testing for the strength requirements. Second, it is used in S4.3 to define the reference point for determining compliance with the location requirements. These commenters stated that the new definition will result in confusion with regard to determining the location of the anchorage.

The agency admits that this rulemaking had focused exclusively on clarifying the definition as it applies to the strength requirements of S4.2. The agency had not fully considered the effect of the proposed definition on the anchorage location requirements of S4.3. The agency has reviewed S4.3 to determine if the inclusion of attachment hardware in the definition of "seat belt anchorage" will confuse the means of measuring the location of the anchorage. Except as noted below, the agency believes that the anchorage locations are specified by means that are not distorted by the new definition. For example, S4.3.1.4 uses the phrase "the vertical centerlines of the bolt holes." a location which is constant under both the current definition and the definition in this final rule.

VW stated that, in S4.3.1.1(a) and (b), the words "hardware attaching it to the" should be deleted. The agency agrees with VW that these words are superfluous under the new definition. VW also stated that references to the anchorage being attached to the seat in S4.3.1.3 are inconsistent with the new definition. Since the seat would be considered part of the anchorage in this situation, the agency also agrees that this section should be revised. The agency finds for good cause that notice and opportunity to comment on these amendments is not necessary. The changes are merely semantic and do not affect the requirements of these sections.

Buckles.

Three commenters (Chrysler, Ford, and VW) noted that, in discussing safety belt buckles in the preamble, the agency stated that the definition of "seat belt anchorage" was not intended to include buckles surrounded by webbing. These commenters stated that this discussion did not include less obvious safety belt designs permitted by Standard No. 209, such as metal straps.

The agency's intent in the discussion of the NPRM preamble was to clarify that the definition of seat belt anchorage included only the attachment points of the seat belt, and not the webbing, straps or similar device, or the buckles which comprise the seat belt itself. This discussion was intended to clarify that the phrase "other than the safety belt webbing or strap" was not

intended to imply that the buckle was part of the anchorage. Since the webbing and straps are also involved in transferring loads to the vehicle structure, this phrase was intended to emphasize that they were not included in the anchorage.

Cross-Reference in 207.

Ford stated that any enforcement questions about the scope of Standard No. 210 for seat-mounted anchorages could be resolved by cross-referencing the requirement in S4.2(c) of Standard No. 207 with the requirement for simultaneous testing in Standard No. 210. The agency disagrees. The suggested cross-reference would not resolve questions that have arisen for seats which are not subject to the requirements of Standard No. 207, for example, seats in small school buses. The suggested cross-reference would also not solve the problem of the number of incomplete tests which result when attachment hardware breaks during the Standard No. 210 tests. Hence, the suggested cross-reference is not adopted in this rule.

In consideration of the foregoing, 49 CFR 571.210 is amended as follows:

S3 of Standard No. 210 is revised to read as follows:

S3. Definition. "Seat belt anchorage" means any component, other than the webbing or straps, involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure.

3. S4.3 of Standard No. 210 is amended by revising S4.3.1.1 and S4.3.1.3 to read as follows:

S4.3 Location.

* * * * *

S4.3 1.1 In an installation in which the seat belt does not bear upon the seat frame:

(a) If the seat is a nonadjustable seat, then a line from the seating reference point to the nearest contact point of the belt with the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

(b) If the seat is an adjustable seat, then a line from a point 2.50 inches forward of and 0.375 inches above the seating reference point to the nearest contact point of the belt with the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

* * * * *

S4.3.1.3 In an installation in which the seat belt attaches to the seat structure, the line from the seating reference point to the nearest contact point of the belt with the hardware attaching it to the seat structure shall extend forward from that contact point at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

Issued on: November 27, 1991.

Jerry Ralph Curry
Administrator

56 F.R. 63682
December 5, 1991

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 210
Seat Belt Assembly Anchorages

(Docket No. 87–02; Notice 6)
(Docket No. 90–26; Notice 3)
RIN 2127–AD43
RIN 2127–AD44

ACTION: Final rule; delay of effective date and response to petitions for reconsideration.

SUMMARY: In response to petitions for reconsideration, this final rule amends Standard No. 210 to clarify the location for measuring compliance with the anchorage location requirements, and to allow for other means of attaching the anchorage to the vehicle structure. In addition, this final rule extends the effective date for a number of recent amendments to Standard No. 210 one year. These amendments imposed significant new requirements which are still not clear to the vehicle and equipment manufacturers. This delay will allow sufficient time for the manufacturers to make any necessary changes in their vehicle designs to accommodate these new requirements.

EFFECTIVE DATE: September 1, 1993.

SUPPLEMENTARY INFORMATION:

Background

On April 30, 1990, the agency published a final rule amending several requirements of Federal motor vehicle safety standard No. 210, Seat belt assembly anchorages, (55 F.R. 17970). On December 4, 1991, the agency further amended Standard No. 210 in response to seven petitions for reconsideration of the April 1990 final rule (56 F.R. 63676). On the same day, the agency also published a final rule clarifying the definition of "anchorage" in Standard No. 210 (56 F.R. 63682).

As a result of these three final rules, the following amendments were made to Standard No. 210—

1. The definition of "seat belt anchorage" was amended to explicitly state that any vehicle part or component that transfers the load from a safety belt to the vehicle structure is part of the anchorage (effective 9/1/92).

2. The amendment to the definition of "seat belt anchorage" had the effect of requiring the attachment hardware to withstand the 3,000 pound forces during the strength test. While attachment hardware for manual safety belts is still affected, the attachment hardware for dynamically-tested and automatic safety belts was excluded (effective 9/1/92).

3. The minimum lap belt angle for front seats was increased from 20° to 30° (effective 9/1/92).

4. The minimum lap belt angle for rear seats was increased from 20° to 30° (effective 9/1/93).

5. Simultaneous testing of all anchorages common to a single occupant seat and of anchorages not common to the same occupant seat but within 12 inches of each other was required (effective 9/1/92).

6. The use of a narrower body block during strength testing was allowed as an option (effective 9/1/92).

7. Use of wire cable or strong webbing to restrain the body block during strength tests was allowed (effective 9/1/92).

8. The term "hip point" was substituted for the term "seating reference point" in the definition of "outboard designated seating position" and for the location of the upper anchorage zone (effective 9/1/92)

9. All redundant anchorage requirements were removed (already in effect, as of 4/30/90).

The agency received four petitions for reconsideration of the two December 5, 1991, final rules. This notice responds to those petitions.

Issues

1. *Definition*

The December 5, 1991, final rule amending the definition of "seat belt anchorage" in Standard No. 210 was intended to make it clear that any vehicle part or component that transfers the load from a safety belt to the vehicle structure is part of the anchorage. The amended definition is—

> "Seat belt anchorage" means any component, other than the webbing or straps, involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure.

In the preamble to the final rule, the agency stated that "[t]he new definition gives examples of some of the components whose failure would result in non-compliance with Standard No. 210, without limiting the scope of the definition to those enumerated components."

Both Ford and Toyota petitioned that the definition of "seat belt anchorage" be amended by adding various components to either the list of inclusions or the list of exclusions in the definition. The agency already considered the option of listing many specific components and decided not to take that course of action. The agency believed that being too specific would undesirably restrict the definition. The agency continues to be hesitant to list specific components in the definition of anchorage, or conversely, to list components that are excluded from this definition, as the definition would then deal inadequately with designs not contemplated by the agency at the time of drafting the list. For this reason, the agency is not amending the definition of "seat belt anchorage" as requested.

In its petition, Ford has asked whether the D-ring is part of the anchorage "[i]n seat belt assemblies where the D-ring is attached to the structure by a webbing strap." The webbing discussed in the final rule as being excluded from the definition of "seat belt anchorage" was the webbing that encompasses the occupant; not webbing used as attachment hardware. NHTSA believes that the attachment hardware should include all the equipment that attaches the safety belt to the vehicle structure. The safety belt system is tested in Standard No. 209, Seat belt assemblies. However, the D-ring and its attachment are not tested as part of the Standard No. 209 test. Therefore, the agency considers the D-ring to be part of the safety belt anchorage.

In another question regarding the definition, Toyota provided a sketch of a safety belt system which has a strap hooked directly to the anchorage bolt. For this design, the agency would consider it a failure of the Standard No. 210 test if the strap pulled away from the bolt. However, if the strap failed at the buckle, the agency would not consider the failure a non-compliance with the strength requirements of Standard No. 210.

2. *Location Requirements*

The only amendment to Standard No. 210 that was intended to affect the location requirements was the one increasing the minimum lap belt angle to 30 degrees.

Ford and Volkswagen stated that the upper anchorage location requirement in S4.3.2 was not clear. This section states that the upper anchorage must be within a specified zone. With the addition of attachment hardware to the definition of anchorage, Ford and Volkswagen stated that it is not clear what must remain within this zone.

NHTSA agrees with these petitioners. In amending Standard No. 210, the agency did not intend to change the stringency of the requirement for locating upper restraint anchorages. Before the addition of attachment hardware to the definition of anchorage, the determination of the upper anchorage's compliance with the location requirements was made with reference to the upper anchorage bolt hole. The agency believes that this reference is still appropriate for non-adjustable anchorages. Accordingly, NHTSA is amending S4.3.2 to state that the center of the anchorage bolt hole must be within the upper anchorage location zone.

Several additional location issues were raised by Ford and Volkswagen. First, Volkswagen requested that the location requirements not reference a bolt hole in case the vehicle manufacturer wishes to weld the safety belt attachment hardware to the vehicle, instead of using a bolt. NHTSA agrees with Volkswagen that reference to a bolt hole could be design restrictive. Therefore, the agency is amending S4.3.2 to require that either "the vertical centerline of the bolt holes, or, for designs using other means of attachment to the vehicle structure, at the centroid of such

means" must be in the zone. This amendment will accommodate welding or other attachment techniques.

In accommodating welded anchorages, the agency wants to note that it and most of the automotive industry encourage replacement of the safety belt system after a moderate crash. Welding the safety belt attachment hardware may increase the difficulty of replacing safety belt systems. Therefore, despite its adoption of the amendment to permit other means of attaching the safety belt to the vehicle, the agency encourages manufacturers to design their belt systems so as to facilitate replacement of those systems.

Second, Ford raised concerns about the location requirements for adjustable upper anchorages (AUA). The agency recognizes adjustable anchorages may be attached to the vehicle in multiple locations, a possibility which is not accommodated by the language of S4.3.2. To date, the agency has interpreted the location provisions as requiring that the bolts holding the adjustable anchorage must be in the upper anchorage zone. However, as stated earlier, the agency did not intend all of the attachment hardware for an AUA to remain in the zone. Accordingly, the agency is amending this final rule, as suggested by Ford in its petition for reconsideration, to require that the midpoint of the range of all adjustment positions remain within the required zone. This amendment will only affect rear outboard anchorages in vehicles equipped with automatic restraints and the front and rear outboard anchorages in the small number of vehicles with gross vehicle weight rating between 8,500 and 10,000 pounds. It will not affect the front outboard anchorages on all vehicles equipped with automatic restraints since those anchorages are excluded from the anchorage location requirements.

3. *Dynamically Tested Safety Belts*

The April 30, 1990 final rule extended the applicability of Standard No. 210 to the attachment hardware of a safety belt system. Responding to the petitions for reconsideration, the December 5, 1991 final rule excluded the attachment hardware for seat belt assemblies that meet the frontal crash protection requirements of S5.1 of Standard No. 208. The preamble noted that the agency does not consider a manual belt installed at a seating position that is also equipped with an airbag to be a dynamically tested belt. It stated that the attachment hardware for these belts is therefore still subject to the Standard No. 210 strength tests.

Volkswagen petitioned the agency to reconsider its position that manual belts installed at a seating position equipped with an airbag are not dynamically tested. In the alternative, Volkswagen asked that manufacturers be given the option of dynamically testing these manual belt systems in lieu of Standard No. 209 and Standard No. 210 testing.

The agency believes that this issue has already received adequate review, and that the automotive industry has had sufficient opportunity to voice objection in previous rulemaking actions regarding this issue. No other petitions have been received on this issue. Further, no other petitioners asked to eliminate the existing static strength and attachment hardware tests. In addition, Volkswagen has provided no new data or information that would support its petition. Therefore, the agency has decided that this aspect of Volkswagen's petition for reconsideration should be denied.

Concerning Volkswagen's request that manufacturers be allowed to dynamically test safety belts in vehicles with airbags in lieu of required compliance with Standards No. 209 and 210, this is already an option. Manufacturers may select any reasonable basis for determining compliance with safety standard requirements. Therefore, if the manufacturer believes that a dynamic test would provide a sufficient basis for certifying compliance with aspects of Standards No. 209 and 210, a manufacturer may choose to determine compliance using a series of dynamic tests. However, the agency would determine compliance by means of the static tests specified by Standard No. 210.

4. *Leadtime*

The Ford petition stated that if the attachment hardware had to be located entirely within the anchorage zones, the location of some anchorages would have to be changed. This would require more time than the time remaining between now and September 1, 1992. As explained previously, it was not the intent of the agency to include all attachment hardware within the location requirements.

The agency has reviewed the changes in Standard No. 210 since the April 1990 final rule and the December 1991 final rules (effective Septem-

ber 1992 and September 1993). The agency imposed significant requirements in these amendments, such as the inclusion of attachment hardware in the strength test and the addition of testing more than one set of anchorages at the same time.

It is apparent that many significant issues are still not clear to the vehicle and equipment manufacturers. Not only has the agency received these four petitions for reconsideration within nine months of the effective date, but it also continues to receive informal inquiries concerning the definitions and the test requirements of these changes. Based on this experience, NHTSA believes it desirable to extend the effective date of these amendments until September 1, 1993. This delay applies to the following final rules: 55 F.R. 17970, April 30, 1990 (except for the amendment to S4.1.3 which was effective April 30, 1990); 55 F.R. 24240, June 15, 1990; 56 F.R. 63676, December 5, 1991; and 56 F.R. 63682, December 5, 1991.

This final rule does not have any retroactive effect. Under section 103(d) of the National Traffic and Motor Vehicle Safety Act (Safety Act; 15 U.S.C. 1392(d)), whenever a Federal motor vehicle safety standard is in effect, a State may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard, except to the extent that the State requirement imposes a higher level of performance and applies only to vehicles procured for the State's use. Section 105 of the Safety Act (15 U.S.C. 1394) sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

S4.3.1.4 of Standard No. 210 is revised to read as follows—

S4.3.1.4 Anchorages for an individual seat belt assembly shall be located at least 6.50 inches apart laterally, measured between the vertical centerline of the bolt holes or, for designs using another means of attachment to the vehicle structure, between the centroid of such means.

S4.3.2 of Standard No. 210 is revised to read as follows—

S4.3.2 Seat belt anchorages for the upper torso portion of Type 2 seat belt assemblies. Adjust the seat to its full rearward and downward position and adjust the seat back to its most upright position. With the seat and seat back so positioned, as specified by subsection (a) or (b) of this section, the upper end of the upper torso restraint shall be located within the acceptable range shown in Figure 1, with reference to a two-dimensional drafting template described in SAE Recommended Practice J826 (May 1987). The template's "H" point shall be at the design "H" point of the seat for its full rearward and full downward position, as defined in SAE Recommended Practice J1100 (June 1984), and the template's torso line shall be at the same angle from the vertical as the seat back.

(a) For fixed anchorages, compliance with this section shall be determined at the vertical centerline of the bolt holes or, for designs using another means of attachment to the vehicle structure, at the centroid of such means.

(b) For adjustable anchorages, compliance with this section shall be determined at the midpoint of the range of all adjustment positions.

Frederick H. Grubbe
Deputy Administrator

57 F.R. 32902
July 24, 1992

MOTOR VEHICLE SAFETY STANDARD NO. 210
Seat Belt Assembly Anchorages—Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses

(Docket No. 2–14; Notice No. 4)

S1. Purpose and scope. This standard establishes requirements for seat belt assembly anchorages to insure their proper location for effective occupant restraint and to reduce the likelihood of their failure.

S2. Application. This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

S3. Definition. *Seat belt anchorage* means any component, other than the webbing or straps, involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, seat frames, seat pedestals, the vehicle structure itself, and any part of the vehicle whose failure causes separation of the belt from the vehicle structure.

S4. Requirements.

S4.1 Type.

S4.1.1 Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each forward-facing outboard designated seating position in passenger cars, other than convertibles, and for each designated seating position for which a Type 2 seat belt assembly is required by Standard No. 208 (49 CFR 571.208) in vehicles other than passenger cars. Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each rear forward-facing outboard designated seating position in convertible passenger cars manufactured on or after September 1, 1991.

S4.1.2 Seat belt anchorages for a Type 1 or a Type 2 seat belt assembly shall be installed for each designated seating position, except a passenger seat in a bus or a designated seating position for which seat belt anchorages for a Type 2 seat belt assembly are required by S4.1.1.

S4.1.3 (a) Notwithstanding the requirement of S4.1.1, each vehicle manufactured on or after September 1, 1987, that is equipped with an automatic restraint at the front right outboard designated seating position, which automatic restraint cannot be used for securing a child restraint system solely through the use of attachment hardware installed as an item of original equipment by the vehicle manufacturer shall have, at the manufacturer's option, either anchorages for a Type 1 seat belt assembly installed at that position or a Type 1 or Type 2 seat belt assembly installed at the position. If a manufacturer elects to install anchorages for a Type 1 seat belt assembly to comply with this requirement, those anchorages shall consist of, at a minimum, holes threaded to accept bolts complying with S4.1(f) of Standard No. 209 (49 CFR 571.209).

(b) The requirement in S4.1.1 and S4.1.2 of this standard that seat belt anchorages for a Type 1 or a Type 2 seat belt assembly shall be installed for certain designated seating positions does not apply to any such seating positions that are equipped with a seat belt assembly that meets the frontal crash protection requirements of S5.1 of Standard No. 208 (49 CFR 571.208).

S4.2 Strength.

S4.2.1 Except as provided in S4.2.5, and except for side-facing seats, the anchorages, attachment hardware, and attachment bolts for any of the following seat belt assemblies shall withstand a 5,000-pound force when tested in accordance with S5.1 of this standard—

(a) Type 1 seat belt assembly;

(b) Lap belt portion of either a Type 2 or automatic seat belt assembly, if such seat belt assembly is voluntarily installed at a seating position; and

(c) Lap belt portion of either a Type 2 or automatic seat belt assem-

bly is equipped with a detachable upper torso belt.

S4.2.2 Except as provided in S4.2.5, the anchorages, attachment hardware, and attachment bolts for all Type 2 and automatic seat belt assemblies that are installed to comply with Standard No. 208 (49 CFR 571.208) shall withstand 3,000-pound forces when tested in accordance with S5.2.

S4.2.3 Permanent deformation or rupture of a seat belt anchorage or its surrounding area is not considered to be a failure, if the required force is sustained for the specified time.

S4.2.4 Anchorages, attachment hardware, and attachment bolts shall be tested by simultaneously loading them in accordance with the applicable procedures set forth in S5 of this standard if the anchorages are either—

(a) For designated seating positions that are common to the same occupant seat and that face in the same direction; or

(b) For laterally adjacent designated seating positions that are not common to the same occupant seat, but that face in the same direction, if the vertical centerline of the bolt hole for at least one of the anchorages for one of those designated seating positions is within 12 inches of the vertical centerline of the bolt hole for an anchorage for one of the adjacent seating positions.

S4.2.5 The attachment hardware of a seat belt assembly, which is subject to the requirements of S5.1 of Standard No. 208 (49 CFR 571.208) by virtue of any provision of Standard No. 208 (49 CFR 571.208) by virtue of any provision of Standard No. 208 other than S4.1.2.1(c)(2) of that standard, does not have to meet the requirements of S4.2.1 and S4.2.2 of this standard.

S4.3 Location. As used in this section, "forward" means in the direction in which the seat faces, and other directional references are to be interpreted accordingly. Anchorages for seat belt assemblies that meet the frontal crash protection requirements of S5.1 of Standard No. 208 (49 CFR Part 571.208) are exempt from the location requirements of this section.

S4.3.1 Seat belt anchorages for Type 1 seat belt assemblies and the pelvic portion of Type 2 seat belt assemblies.

S4.3.1.1 In an installation in which the seat belt does not bear upon the seat frame—

(a) If the seat is a nonadjustable seat, then a line from the seating reference point to the nearest contact point of the belt with the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

(b) If the seat is an adjustable seat, then a line from a point 2.50 inches forward of and 0.375 inch above the seating reference point to the nearest contact point of the belt with the anchorage shall extend forward from the anchorage at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

S4.3.1.2 In an installation in which the belt bears upon the seat frame, the seat belt anchorage, if not on the seat structure, shall be aft of the rearmost belt contact point on the seat frame with the seat in the rearmost position. The line from the seating reference point to the nearest belt contact point on the seat frame, with the seat positioned at the seating reference point, shall extend forward from that contact point at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

S4.3.1.3 In an installation in which the seat belt attaches to the seat structure, the line from the seating reference point to the nearest contact point of the belt with the hardware attaching it to the seat structure shall extend forward from that contact point at an angle with the horizontal of not less than 30 degrees and not more than 75 degrees.

S4.3.1.4 Anchorages for an individual seat belt assembly shall be located at least 6.50 inches apart laterally, measured between the vertical centerline of the bolt holes [or, for designs using another means of attachment to the vehicle structure, between the centroid of such means. **(57 F.R. 32902—July 24, 1992. Effective: September 1, 1993.)**]

S4.3.1.5 Notwithstanding the provisions of S4.3.1.1 through S4.3.1.4, the lap belt angle for seats behind the front row of seats shall be between 20 degrees and 75 degrees for vehicles manufactured between September 1, 1992 and September 1, 1993.

S4.3.2 Seat belt anchorages for the upper torso portion of Type 2 seat belt assemblies. [Adjust the seat to its full rearward and downward position and adjust the seat back to its most upright position. With the seat and seat back so positioned, as specified by subsection (a) or (b) of this section, the upper end of the upper torso restraint shall be located within the acceptable range shown in Figure 1, with reference to a two-dimensional drafting template described in SAE Recommended Practice J826 (May 1987). The template's "H" point shall be at the design "H" point of the seat for its full rearward and full downward position, as defined in SAE Recommended Practice J1100 (June 1984), and the template's torso line shall be at the same angle from the vertical as the seat back.

(a) For fixed anchorages, compliance with this section shall be determined at the vertical centerline of the bolt holes or, for designs using another means of attachment to the vehicle structure, at the centroid of such means.

(b) For adjustable anchorages, compliance with this section shall be determined at the midpoint of the range of all adjustment positions. **(57 F.R. 32902—July 24, 1992. Effective: September 1, 1993.)]**

S5. Test procedures. Each vehicle shall meet the requirements of S4.2 of this standard when tested according to the following procedures. Where a range of values is specified, the vehicle shall be able to meet the requirements at all points within the range. For the testing specified in these procedures, the anchorage shall be connected to material whose breaking strength is equal to or greater than the breaking strength of the webbing for the seat belt assembly installed as original equipment at that seating position. The geometry of the attachment duplicates the geometry, at the initiation of the test, of the attachment of the originally installed seat belt assembly.

S5.1 Seats with Type 1 or Type 2 seat belt anchorages. With the seat in its rearmost position, apply a force of 5,000 pounds in the direction in which the seat faces to a pelvic body block as described in Figure 2A, in a plane parallel to the longitudinal centerline of the vehicle, with an initial force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. Apply the force at the onset rate of not more than 50,000 pounds per second. Attain the 5,000 pound force in not more than 30 seconds and maintain it for 10 seconds. At the manufacturer's option, the pelvic body block described in Figure 2B may be substituted for the pelvic body block described in Figure 2A to apply the specified force to the center set(s) of anchorages for any group of three or more sets of anchorages that are simultaneously loaded in accordance with S4.2.4 of this standard.

S5.2 Seats with Type 2 seat belt anchorages. With the seat in its rearmost position, apply forces of 3,000 pounds in the direction in which the seat faces simultaneously to a pelvic body block, as described in Figures 2A, and an upper torso body block, as described in Figure 3, in a plane parallel to the longitudinal centerline of the vehicle, with an initial force application angle of not less than 5 degrees nor more than 15 degrees above the horizontal. Apply the forces at the onset rate of not more than 30,000 pounds per second. Attain the 3,000-pound forces in not more than 30 seconds and maintain it for 10 seconds. At the manufacturer's option, the pelvic body block described in Figure 2B may be substituted for the pelvic body block described in Figure 2A to apply the specified force to the center set(s) of anchorages for any group of three or more sets of anchorages that are simultaneously loaded in accordance with S4.2.4 of this standard.

S6. Owner's Manual Information. The owner's manual in each vehicle with GVWR of 10,000 pounds or less, manufactured after September 1, 1987, shall include—

(a) A section explaining that all child restraint systems are designed to be secured in vehicle seats by lap belts or the lap belt portion of a lap-shoulder belt. The section shall also explain that children could be endangered in a crash if their child restraints are not properly secured in the vehicle.

(b) In a vehicle with rear designated seating positions, a statement alerting vehicle owners that, according to accident statistics, children are safer

when properly restrained in the rear seating positions than in the front seating positions.

(c) In each passenger car, a diagram or diagrams showing the location of the shoulder belt anchorages required by this standard for the rear outboard designated seating positions, if shoulder belts are not installed as items of original equipment by the vehicle manufacturer at those positions.

S7. Installation instructions. The owner's manual in each vehicle manufactured on or after September 1, 1987, with an automatic restraint at the front right outboard designated seating position that cannot be used to secure a child restraint system when the automatic restraint is adjusted to meet the performance requirements of S5.1 of Standard No. 208 shall have—

(a) A statement that the automatic restraint at the front right outboard designated seating position cannot be used to secure a child restraint and as appropriate, one of the following three statements—

(1) A statement that the automatic restraint at the front right outboard designated seating position can be adjusted to secure a child restraint system using attachment hardware installed as original equipment by the vehicle manufacturer;

(2) A statement that anchorages for installation of a lap belt to secure a child restraint system have been provided at the front right outboard designated seating position; or

(3) A statement that a lap or manual lap or lap/shoulder belt has been installed by the vehicle manufacturer at the front right outboard designated seating position to secure a child restraint.

(b) In each vehicle in which a lap or lap/shoulder belt is not installed at the front right outboard designated seating position as an item of original equipment, but the automatic restraint at that position can be adjusted by the vehicle owner to secure a child restraint system using an item or items of original equipment installed in the vehicle by the vehicle manufacturer, the owner's manual shall also have—

(1) A diagram or diagrams showing the location of the attachment has hardware provided by the vehicle manufacturer.

(2) A step-by-step procedure with a diagram or diagrams showing how to modify the automatic restraint system to secure a child restraint system. The instructions shall explain the proper routing of the attachment hardware.

(c) In each vehicle in which the automatic restraint at the front right outboard designated seating position cannot be modified to secure a child restraint system using attachment hardware installed as an original equipment by the vehicle manufacturer and a manual lap or lap/shoulder belt is not installed as an item of original equipment by the vehicle manufacturer, the owner's manual shall also have—

(1) A diagram or diagrams showing the locations of the lap belt anchorages for the front right outboard designated seating position.

(2) A step-by-step procedure and a diagram or diagrams for installing the proper lap belt anchorage hardware and a Type 1 lap belt at the front right outboard designated seating position. The instructions shall explain the proper routing of the seat belt assembly and the seat belt attachment of the assembly to the lap belt anchorages.

51 F.R. 29552
August 19, 1986

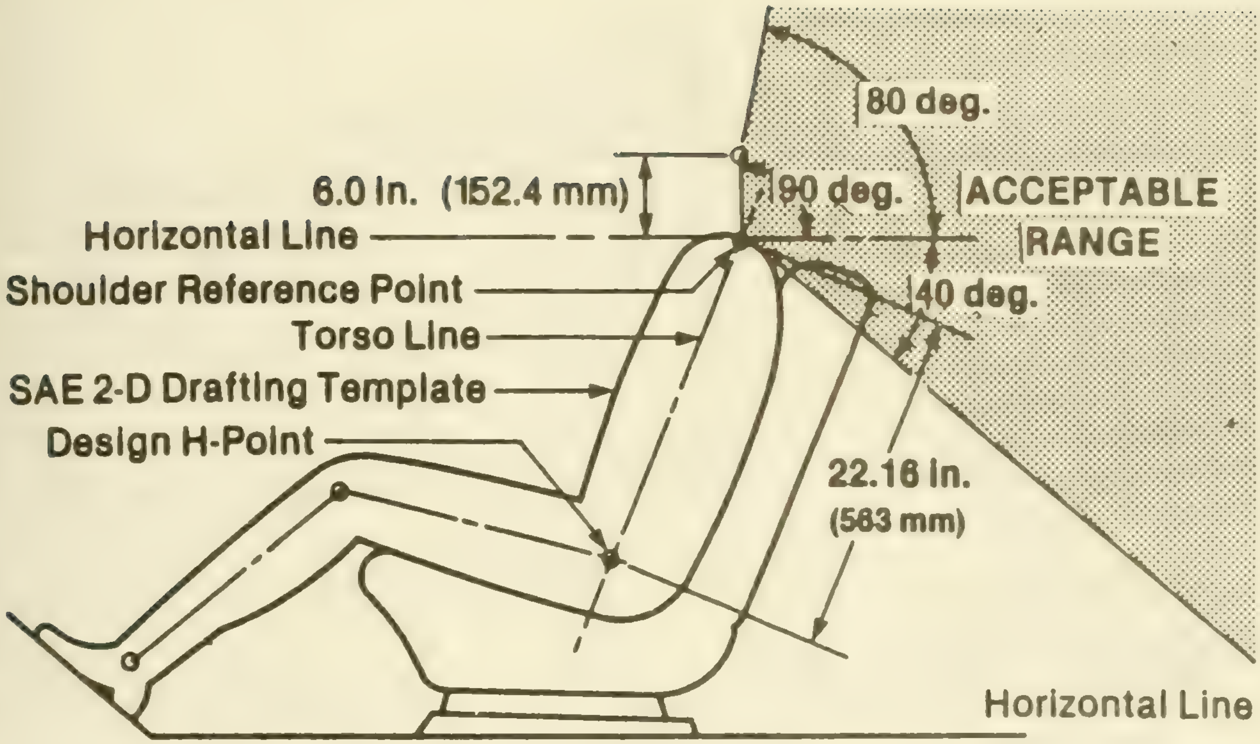


FIGURE 1 - LOCATION OF ANCHORAGE FOR UPPER TORSO RESTRAINT

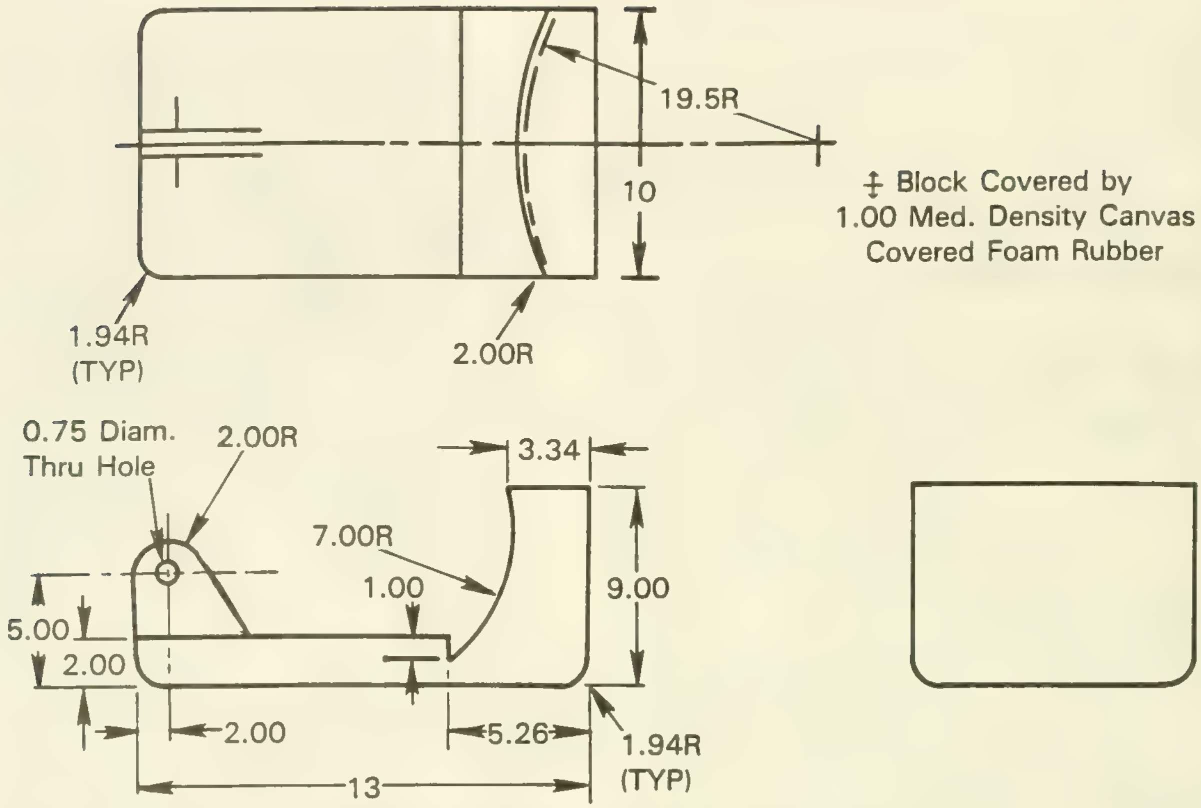


Figure 2. Body Block for Lap Belt Anchorage

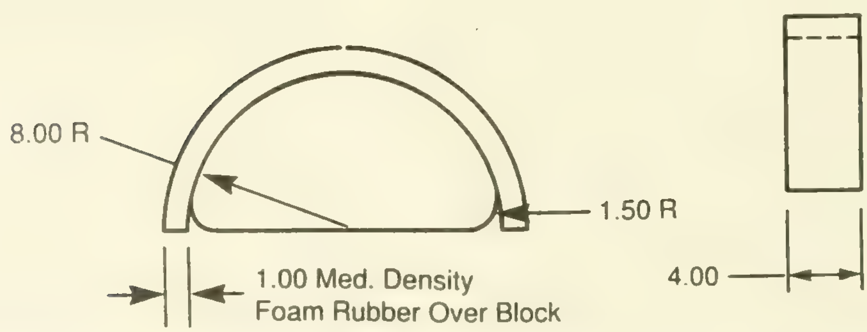


Figure 3. Body Block for Combination Shoulder and Lap Belt Anchorage

MOTOR VEHICLE SAFETY STANDARD NO. 211

Wheel Nuts, Wheel Discs, and Hub Caps—Passenger Cars and Multipurpose Passenger Vehicles

S1. Purpose and scope. This standard precludes the use of wheel nuts, wheel discs, and hub caps that constitute a hazard to pedestrians and cyclists.

S2. Application. This standard applies to passenger cars, multipurpose passenger vehicles, and passenger cars and multipurpose passenger vehicle equipment.

S3. Requirements. Wheel nuts, hub caps, and wheel discs for use on passenger cars and multipurpose passenger vehicles shall not incorporate winged projections.

INTERPRETATION

A clarification of the term "wheel nut" as used in the requirements section S3 of Standard No. 211 has been requested. This section states that "wheel nuts, hub caps, and wheel discs for use on passenger cars and multipurpose passenger vehicles shall not incorporate winged projections." A "wheel nut" is an exposed nut that is mounted at the center or hub of a wheel, and not the ordinary small hexagonal nut, one of several which secures a wheel to an axle, and which is normally covered by a hub cap or wheel disc.

Issued on July 22, 1969.

F. C. Turner
Federal Highway Administrator

32 F.R. 2416
February 3, 1967

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 212

Windshield Mounting—Passenger Cars

A proposal to amend Part 371 of the Federal Motor Vehicle Safety Standards by adding a Standard No. 212, Windshield Mounting—Passenger Cars, was published as an advance notice of proposed rule making an October 14, 1967 (32 F.R. 14281) and a notice of proposed rule making on December 28, 1967 (32 F.R. 20866).

Interested persons have been given the opportunity to participate in the making of this amendment, and careful consideration has been given to all relevant matter presented.

This new standard requires that, when tested as prescribed, each passenger car windshield mounting must retain either: (1) not less than 75% of the windshield periphery; or (2) not less than 50% of that portion of the windshield periphery on each side of the vehicle longitudinal centerline, if an unrestrained 95th percentile adult male manikin is seated in each outboard front seating position.

Several comments objected to the proposed standard and in some cases urged that more research should be done before any type of windshield mounting is required. The standard, is however, part of an integrated program aimed at accomplishing the widely accepted safety goal of keeping occupants within the confines of the passenger compartment during a crash. One major step in this program is the utilization of the laminated glazing material prescribed in Federal motor vehicle safety standard No. 205, which has resulted in a marked reduction in serious head injury to occupants known to have struck the windshield. The windshield mounting retention requirement prescribed in this standard takes advantage of this improved glazing material and will further minimize the likelihood of occupants being thrown from the vehicle during a crash.

Several comments requested reduction of the 75% retention requirement to 50%. The Administrator concludes that, as an alternative, 50% retention is acceptable if: (1) an unrestrained 95% percentile adult male manikin is seated in each outboard front seating position when the test procedure is performed, and (2) at least 50% of that portion of the windshield periphery on each side of the vehicle longitudinal centerline is retained.

Several comments requested that the phrase "or approved equivalent" be added to the "Demonstration procedures" provision. § 371.11 of the Federal motor vehicle safety standards provides that "an approved equivalent may be substituted for any required destructive demonstration procedure." Consequently, inclusion of the phrase requested is not necessary.

In consideration of the foregoing, § 371.21, of Part 371 of the Federal motor vehicle safety standards is amended by adding Standard No. 212, "Windshield Mounting—Passenger Cars," as set forth below, effective January 1, 1970.

This rule-making action is taken under the authority of sections 103 and 119 of the National Traffic and Motor Vehicle Safety Act of 1966 (P.L. 89-563, 15 U.S.C. §§ 1392 and 1407) and the delegation of authority contained in Part 1 of the Regulations of the Office of the Secretary of Transportation (49 CFR Part 1).

Issued in Washington, D.C. on August 13, 1968.

John R. Jamieson, Deputy
Federal Highway Administrator

33 F.R. 11652
August 16, 1968

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 212

Windshield Mounting

(Docket No. 69–29; Notice 5)

This notice amends Motor Vehicle Safety Standard No. 212, 49 CFR 571.212, *Windshield Mounting*, to extend its applicability to multipurpose passenger vehicles, trucks, and buses having a gross vehicle weight rating (GVWR) of 10,000 pounds or less, except for forward control vehicles and open-body type vehicles with folding or removable windshields, and to coordinate its test procedures with those of Standard No. 208, 49 CFR 571.208, *Occupant Crash Protection*.

An advance notice of proposal rulemaking was published September 16, 1969 (34 FR 14438), followed by notices of proposed rulemaking published on August 23, 1972 (37 FR 16979) and January 18, 1974 (39 FR 2274). This notice is based on the latter notice of proposed rulemaking, and responds to the comments submitted thereto.

The final rule retains the proposed rule's extension to multipurpose passenger vehicles, trucks, and buses having a gross vehicle weight rating (GVWR) of 10,000 pounds or less. However, forward control vehicles and open-body vehicles with fold-down windshields are excluded from the application of the standard because of the impracticability of complying with the requirements.

Many manufacturers objected to the requirement in the proposal that the dummies used in the test vehicle not be restrained by active restraint systems. Upon impact in a crash test, unrestrained dummies tend to fly about the passenger compartment, damaging the dummies.

In 1972 the NHTSA proposed the amendment of Standard No. 212 (37 FR 16979) to specify a 75 percent retention requirement using restrained dummies. The purpose of the proposal was to eliminate optional retention requirements and to permit dynamic testing consistent with other safety standards. In 1974 another approach was taken with the NHTSA proposing (39 FR 2274) a 50 percent retention requirement using unrestrained dummies, in anticipation of the passive restraint requirements that were to be included in Standard No. 208. Having the benefit of a large number of comments on both proposals the NHTSA has determined that both are suitable, the 1972 approach for vehicles equipped with active restraints, where dummy damage would be great if the dummy were unrestrained, and the 1974 approach for vehicles equipped with passive restraints, since the dummy would not contact the windshield.

The frontal barrier crash test conditions specified in the final rule are substantially similar to those of Standard No. 208, *Occupant Crash Protection*, Standard No. 219, *Windshield Zone Intrusion*, and Standard No. 301, *Fuel System Integrity*. This will allow compliance testing for these standards in one crash test under certain circumstances. In this way, much of the expense associated with crash testing can be reduced.

Most of the manufacturers who commented on the proposal objected to the requirement that the vehicle be tested at a temperature range of 15° F to 110° F. Some manufacturers objected that the higher temperatures would damage sensitive instrumentation. Others argued that the range should be coordinated with that of Standard No. 301 (49 CFR 571.301) or with ISO regulations. Some asserted that they would have to build expensive test facilities in order to conduct tests at the temperature extremes. The NHTSA has determined that testing over the specified range is necessary, in light of the fact that wind-

shield moldings have significantly different retention capabilities at different temperatures. The NHTSA recognizes that certain additional expenses may be entailed in testing over the specified temperature range. However, the safety need to ensure adequate windshield retention justifies the additional expense.

In consideration of the foregoing, Standard No. 212, 49 CFR 571.212, is amended to read as set forth below.

Effective date: September 1, 1977.

(Sec. 103, 119, Pub. L. 89563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50)

Issued on: August 23, 1976.

John W. Snow
Administrator

41 F.R. 36493
August 30, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 212

Windshield Mounting

(Docket No. 69–29; Notice 6)

This notice responds to nine petitions for reconsideration of a recent amendment (41 FR 36493, August 30, 1976) of Safety Standard No. 212, *Windshield Mounting*, by extending the effective date of the amendment from September 1, 1977, to September 1, 1978, and by excluding "walk-in van-type" vehicles from the standard's applicability. Other aspects of the petitions for reconsideration are denied.

Dates: The amendment of August 30, 1976, will be effective September 1, 1978. The change in the effective date and the amendment to exclude "walk-in van-type" vehicles from the standard's applicability should be changed in the text of the Code of Federal Regulations, effective August 4, 1977.

For Further Information Contact:

Robert Nelson
National Highway Traffic Safety Administration
Washington, D.C. 20590
(202 426–2802)

Supplementary Information: Safety Standard No. 212, *Windshield Mounting* (49 CFR Part 571.212), was amended August 30, 1976, to modify the performance requirements and test procedures of the standard and to extend the standard's applicability to multipurpose passenger vehicles, trucks, and buses having a gross vehicle weight rating of 10,000 pounds or less. Petitions for reconsideration were received from International Harvester (IH), Jeep Corporation, American Motors Corporation (AMC), Volvo of America Corporation, Toyo Kogyo Co., General Motors Corporation (GM), Rolls Royce Motors, Nissan Motor Co. Ltd., and Leyland Cars.

Requests from some of these petitioners that the new provisions of Standard No. 212 (49 CFR 571.212) be withdrawn entirely are hereby denied, but several modifications are undertaken by the National Highway Traffic Safety Administration (NHTSA), based on a review of the information and arguments submitted.

Nearly all of the petitioners requested that the effective date of the new provisions be changed from September 1, 1977, to September 1, 1978. Petitioners argued that a lead time of one year will be insufficient to accomplish design changes and retooling necessary to adapt passenger-car windshield technology to other vehicle types. Petitioners also pointed out that the specification of a temperature range in the test conditions will require manufacturers to undertake more extensive certification testing than in the past.

The NHTSA has determined that the requests for additional lead time are justified in light of the information submitted regarding design changes that some manufacturers will undertake. The petitions are, therefore, granted in part and the effective date of the new provisions is postponed to September 1, 1978.

In conformity with the agency's 1972 and 1974 proposals (37 FR 16979, August 23, 1972) (39 FR 2274, January 18, 1974), an optional means of meeting the retention requirement (that exists in the present provisions) was eliminated by the August 30, 1976, amendments. This was done to reduce the amount of necessary compliance testing and to encourage "simultaneous" certification testing of separate standards where practicable. As proposed in 1972, the "75-percent alternative" (retention of 75 percent of the windshield periphery—dummies properly restrained) was made mandatory for al vehicles not equipped with passive restraints. In this way, windshield retention tests could be per-

formed at the same time as tests already required for fuel system integrity (49 CFR 571.301-75) that specify restrained dummies.

While some additional weight is added to the vehicle by the required dummies, it is the minimum necessary to permit "simultaneous" testing, and the dummies are restrained so that there is only incidental, if any, contact with the windshield. Thus, the "75-percent alternative" specified in the amendments is, basically, a continuation of the existing requirement that manufacturers have been meeting for years.

The 1974 proposal to adopt the "50-percent option" (retention of 50 percent of the windshield periphery on each side of the windshield—dummies unrestrained) was vigorously objected to by manufacturers because of the damage that could occur to dummies during impact with the windshield. Also, the fuel system integrity standard was made final in a form that required restraining the dummies by safety belts if provided. It was apparent that the "50-percent option" should only become mandatory as proposed for vehicles equipped with passive restraint systems that could protect the dummy against impact damage. In the case of air cushion restraint systems, of course, some contact with the windshield by the cushion or incidental contact by the dummy is expected during the crash test. For this reason, the somewhat less stringent "50-percent option" was made final for vehicles equipped with passive restraints.

AMC argued that this distinction between vehicles is unjustified. The only reason put forward by AMC was that "dummy impact is not a critical factor in determining windshield retention." This reason does not, however, support the AMC request for a reduction in retention performance from the 75-percent level presently being met. Rather, it argues for an increase in the 50-percent level established for those vehicles in which the NHTSA estimated that dummy and restraint contact could affect results. If AMC believes that the distinction is not justified, the agency will review further evidence to increase the 50-percent requirement (for passive-equipped vehicles) to the 75-percent level presently being met in most of today's passenger cars.

Several commenters objected that the final rule differed in some respects from the 1972 and 1974 proposals to amend Standard No. 212, taken separately. AMC, Volvo, and Jeep petitioned to revoke the separate retention requirements for vehicles with different restraint systems, on the grounds that such a distinction had never been proposed. Jeep Corporation also objected to extension of the standard's applicability to MPV's, trucks, and buses because of variations in language from the proposals.

As earlier noted, the requirement for 75-percent retention conforms to the 1972 proposal. The only variation from the 1972 proposal was to implement the performance levels proposed in 1974 for the vehicles that might be equipped with passive restraints. It is the agency's view that "a description of the subjects and issues involved" in the rulemaking action was published in the Federal Register as required by the Administrative Procedure Act (the Act) (5 U.S.C. § 553(b)(2)), permitting opportunity for comment by interested persons. A reading of the cases on this provision of the Act supports the agency's view.

Volvo's petition objected to the fact that the amendments specify the use of restrained dummies in the test procedures. Volvo stated that unrestrained dummies should be used because in actual crash conditions it is the head of an unrestrained occupant that is most likely to impact and substantially load the windshield, since the head of a restrained occupant would not normally contact the windshield.

While Volvo's statement is true, it must be understood that test procedures specified in the standards cannot simulate every element of actual crash conditions. Rather, the procedures are based on a variety of considerations, including test expense and degree of complexity. There were many comments to the prior notices proposing the amendments in question that urged the use of restrained dummies, due to the possibility of damage to the expensive dummies during the barrier crash tests. These comments were taken into consideration prior to issuance of the final rule. Also, the NHTSA concluded that the vehicle deceleration forces are the primary forces affecting windshield retention and

not the impact of occupants with the windshield. The restrained dummies are required, primarily, for purposes of permitting simultaneous testing. The NHTSA concludes that the retention requirements and test procedures specified in the amendments will ensure that vehicles are equipped with windshields that provide the needed protection for occupant safety.

Volvo's petition also argued that Standard No. 212 "must include a measurement procedure that weights the various segments of the windshield periphery in a technically accurate maner." Volso points to tests it has conducted which indicate that "when the unrestrained occupant's head impacts and substantially loads the windshield, the loading will most likely occur in the windshield's upper regions and *not* uniformly throughout the windshield."

While it is recognized that the degree of dislodging of the windshield from its mounting may vary at different locations around the periphery of the windshield, sufficient information is not available on which to base varying retention requirements (for different areas of the windshield). Further, the specification of retention requirements in the terms suggested by Volvo was not proposed by the agency in 1972 or 1974. This aspect of Volvo's petition is therefore denied.

Several petitioners objected to the specification of a temperature range in the test conditions and asked that this provision be withdrawn. Rolls Royce Motors argued that the amendment will require additional tests to determine the most critical temperature for windshield retention and stated that this would greatly increase the burden on low-volume manufacturers. General Motors and Jeep Corporation stated that the expansion of the test requirements over a wide temperature range adds to the stringency of the standard without any evidence of a safety need. American Motors petitioned to remove the 15°F to 110°F temperature range from the barrier test conditions on the basis that "it was not specified as a barrier test condition in the proposal for rulemaking," and on the basis that there are laboratory tests that can serve the same purpose.

The NHTSA denies all petitions to withdraw the temperature range from the standard. As stated in the preamble to the final rule, testing over the specified range is necessary in light of the fact that windshield moldings have significantly different retention capabilities at different temperatures. This fact was graphically confirmed by NHTSA compliance testing in which windshields retained at low temperatures were dislodged at higher temperatures (in identical vehicles). Concerning the objection of American Motors, the temperature range was proposed in paragraph S4 of the 1974 proposal to amend Standard No. 212 (39 FR 2274).

General Motors recommended that the temperature range be revised to specify 66°F to 78°F limits, to coordinate the Standard 212 test with the calibration conditions for the Part 572 dummy. General Motors argued that this would reduce the number of barrier crash tests that would be required.

The NHTSA rejects this recommendation. The Part 572 dummies are conditioned in the 66°F–78°F temperature range for calibration purposes in those standards in which the dynamic dummy response is part of the requirements of the standard. Since the response of the dummy is not directly involved in the performance requirements of Standard No. 212, the temperature of the dummies is not significant. Therefore, it is not necessary to restrict the temperature range of Standard No. 212 to correspond to the calibration temperature range of the Part 572 dummies. For purposes of simultaneous testing, manufacturers could devise a means to control the immediate environment of the test dummy within the 66°F–78°F calibration temperature range, independent of the temperature range specified in Standard No. 212.

General Motors also argued that there could be considerable variation in vehicles condition and test results, depending on when and where the vehicle is tested, since there could be an air temperature of 110°F while windshield components are at a much higher temperature due to "sun load." General Motors, therefore, requested that the temperature requirement be clarified to specify that the temperature of the entire vehicle be stabilized between 15°F and 110°F prior to the test.

The NHTSA does not intend that vehicles be tested with the windshield components at tem-

peratures higher than 110°F. For purposes of clarification, paragraph S6.5 of the new provisions is revised to specify that the windshield mounting material, and all vehicle components in direct contact with the mounting material are to be at any temperature between 15°F and 110°F. Presumably this could be accomplished by localized heating or cooling of the vehicle components or by any other method chosen, in the exercise of due care, by a manufacturer.

The August 1976 amendments to Standard No. 212 modified the application section to include multipurpose passenger vehicles, trucks and buses having a gross weight rating of 10,000 pounds or less. "Open-body type" vehicles and "forward control" vehicles were excluded because of the impracticability of applying the barrier crash test to these vehicles. General Motors has pointed out that the NHTSA failed to exclude "walk-in van-type" vehicles, which have essentially the same configuration and amount of front-end crush space as forward control vehicles.

The NHTSA recently addressed this same issue in connection with Standard No. 219, *Windshield Zone Intrusion*, and, in the absence of any objections, amend that standard to exclude walk-in van-type vehicles (41 FR 54945, December 16, 1976). On reconsideration of the extended applicability of Standard No. 212 to these vehicles, the agency concludes that the same rationale applies. Accordingly, applicability of Standard No. 212 to walk-in van-type vehicles is withdrawn.

In consideration of the foregoing, the effective date of the amendment to Standard No. 212 (49 CFR 571.212) published August 30, 1976 (41 FR 36493) is changed from September 1, 1977, to September 1, 1978, and paragraphs S3 and S6.5 of that text are modified. . . .

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on June 29, 1977.

Joan Claybrook
Administrator

42 F.R. 34288
July 5, 1977

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 212

Windshield Mounting; Windshield Zone Intrusion

(Docket No. 79-14; Notice 02)

ACTION: Final Rule.

SUMMARY: This notice amends two safety standards, Standard No. 212, *Windshield Mounting,* and Standard No. 219, *Windshield Zone Intrusion,* to limit the maximum unloaded vehicle weight at which vehicles must be tested for compliance with these standards. This action is being taken in response to petitions from the Truck Body and Equipment Association and the National Truck Equipment Association asking the agency to amend the standards to provide relief from some of the test requirements for final-stage manufacturers. Many of these small manufacturers do not have the sophisticated test devices of major vehicle manufacturers. The agency concludes that the weights at which vehicles are tested can be lessened while providing an adequate level of safety for vehicles such as light trucks and while ensuring that compliance with these standards does not increase their aggressivity with respect to smaller vehicles.

EFFECTIVE DATE: Since this amendment relieves a restriction by easing the existing test procedure and will not impose any additional burdens upon any manufacturer, it is effective (upon publication).

FOR FURTHER INFORMATION CONTACT:

Mr. William Smith, Crashworthiness Division, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2242)

SUPPLEMENTARY INFORMATION:

On August 2, 1979, the National Highway Traffic Safety Administration published a notice of proposed rulemaking (44 FR 45426) relating to two safety standards: Standard Nos. 212, *Windshield Mounting,* and 219 *Windshield Zone Intrusion.* That notice proposed two options for amending the test procedures of the standards that were designed to ease the compliance burdens of small final-stage manufacturers.

The agency issued the proposal after learning that final-stage manufacturers were frequently unable to certify certain vehicles in compliance with these two safety standards. The problem arises because of weight and center of gravity restrictions imposed upon the final-stage manufacturer by the incomplete vehicle manufacturer. (The final-stage manufacturer typically purchases an incomplete vehicle from an incomplete vehicle manufacturer, usually Ford, General Motors or Chrysler.) The incomplete vehicle usually includes the windshield and mounting but does not include any body or work-performing equipment. Since the incomplete vehicle manufacturer installs the windshield, it represents to the final-stage manufacturer that the windshield will comply with the two subject safety standards. In making this representation, however, the incomplete vehicle manufacturer states that the representation is contingent on the final-stage manufacturer's adherence to certain restrictions. Any final-stage manufacturer that does not adhere to the restrictions imposed by the incomplete vehicle manufacturer must recertify the vehicle based upon its own information, analysis, or tests. The major restrictions imposed by the incomplete vehicle manufacturers on the final-stage manufacturer involve weight and center of gravity limitation. In many instances, these limitations have made it impossible for final-stage manufacturers either to rely on the incomplete vehicle manufacturer's certification or to complete vehicles on the same chassis that they were accustomed to using (prior to the extension of the two safety standards to these vehicle types). As a result, the final-stage manufacturer is faced either with buying

the same chassis as before and recertifying them or with buying more expensive chassis with higher GVWR's and less stringent weight and center of gravity limitations.

The agency has tried several different ways to alleviate this problem for the final-stage manufacturer. The NHTSA has met with representatives of the major incomplete vehicle manufacturers to encourage them to respond voluntarily by strengthening their windshield structures and reducing the restrictions that they currently impose upon final-stage manufacturers. The agency also discussed the possibility of its mandating these actions by upgrading Standards Nos. 212 and 219. Ford and General Motors indicated that the making of any major changes in these standards could lead to their deciding to discontinue offering chassis for use in the manufacturing of multi-stage vehicles. They said that such chassis were a very small percentage of their light truck sales and that, therefore, they would not consider it worth the cost to them to make any extensive modifications in their vehicles. NHTSA also asked the incomplete vehicle manufacturers to be sure that they have properly certified their existing vehicles and that they are not imposing unnecessarily restrictive limitations upon final-stage manufacturers. To this agency's knowledge, these vehicle manufacturers have neither undertaken any strengthening of their vehicles' windshield structures nor lessened any of their restrictions.

At the same time that the agency was made aware of the final-stage manufacturers' problems of certifying to these standards, the agency was becoming concerned about the possibility that compliance of some light trucks and vans with these standards might have made the vehicles more aggressive with respect to smaller passenger cars that they might impact. According to agency information, if these standards require a substantial strengthening of vehicle frames, the aggressivity of the vehicles is increased. Therefore, as a result of the agency's concern about aggressivity and its desire to address the certification problems of final-stage manufacturers in a manner that would not lead to a cessation of a chassis sales to those manufacturers, the agency issued the August 1979 proposal. The agency hoped that the proposal would allow and encourage incomplete vehicle manufacturers to reduce their weight and center of gravity restrictions, thereby easing or eliminating the compliance test burdens of final-stage manufacturers. The agency believed that this could occur using either option, because either would result in vehicles being tested at lower weights. Currently vehicles are tested under both standards at their unloaded vehicle weights plus 300 pounds.

The first option would have required some vehicles whose unloaded vehicle weights exceeded 4,000 pounds to be tested by being impacted with a 4,000 pound moving barrier. The second option proposed by the agency would have required vehicles to be tested at their unloaded vehicle weight up to a maximum unloaded vehicle weight of 5,500 pounds. This option was suggested to the agency by several manufacturers and manufacturer representatives.

Comments on Notice

In response to the agency's notice, nine manufacturers and manufacturer representatives submitted comments. All of the commenters supported some action in response to the problems of final-stage manufacturers. Most of the commenters also suggested that the agency's second alternative solution was more likely to achieve reductions in the restrictions being imposed by incomplete vehicle manufacturers. The first option would have created a new, unproven test procedure, and manufacturers would have been cautious in easing center of gravity or weight restrictions based upon this test procedure. Accordingly, most commenters were not sure that the first option would achieve the desired results. The consensus was, therefore, that the second option should be adopted.

Some manufacturers recommended that both options be permitted allowing the manufacturer to decide how to test its vehicles. The agency does not agree with this recommendation. Not only would it be more difficult and expensive to enforce a standard that has alternative test procedures, but most manufacturers prefer the 5,500 pound weight limit option. The NHTSA concludes that as a result of the comments supporting the 5,500 pound maximum test weight, that this is an acceptable procedure for testing compliance with these two standards. Therefore, the standards are amended to incorporate this procedure.

The major incomplete vehicle manufacturers commenting on the notice suggested that testing vehicles at a maximum weight of 5,500 pounds might provide some immediate relief. None of the major incomplete vehicle manufacturers provided any information concerning how substantial that relief might be. Ford indicated that any relief might be limited.

The agency believes that the incomplete vehicle manufacturers must accept the responsibility for establishing reasonable restrictions upon their incomplete vehicles. The NHTSA has not been provided with sufficient evidence substantiating the statements of the incomplete vehicle manufacturers that their existing restrictions are reasonable. In fact, some evidence indicates that unnecessarily stringent restrictions are being imposed because incomplete vehicle manufacturers do not want to conduct the necessary testing to establish the appropriate weight and center of gravity restrictions. Since this amendment should reduce the severity of the test procedures, the agency concludes that incomplete vehicle manufacturers should immediately review their certification test procedures and reduce the restrictions being passed on to final-stage manufacturers.

Due to changes in the light truck market, there is reason to believe that the incomplete vehicle manufacturers will be more cooperative than when the agency spoke to them before beginning this rulemaking. At that time, light truck sales were still running well. Now that these sales are down, these manufacturers may be more solicitous of the needs of the final-stage manufacturers. If relief is not provided by the incomplete vehicle manufacturers, then the agency will consider taking additional steps, including the upgrading of Standards Nos. 212 and 219 as they apply to all light trucks.

General Motors (GM) questioned one of the agency's rationales for issuing the notice of proposed rulemaking. GM stated that the agency concludes that this action will provide a more appropriate level of safety for the affected vehicles while the initial extension of these standards to the affected vehicles provides, in GM's view, only a slight increase in the level of safety of the vehicles. GM indicates that since the application of these standards to the affected vehicles provides only slight benefits and since this amendment will reduce those benefits, the standards should not apply to light trucks and vans. The agency disagrees with this suggestion.

The agency is currently reviewing the applicability of many of its safety standards to determine whether they ought to be extended to light trucks and other vehicles. Accident data clearly indicate the benefits that have resulted from the implementation of safety standards to cars. The fatality rate for passenger cars has decreased substantially since the implementation of a broad range of safety standards to those vehicles. On the other hand, light trucks and vans have not had a corresponding reduction in fatality rates over the years. The agency attributes much of this to the fact that many safety standards have not been applied to those vehicles. Since those vehicles are becoming increasingly popular as passenger vehicles, the agency concludes that safety standards must apply to them.

In response to GM's comment that this reduction in the test requirements for Standard Nos. 212 and 219 will remove all benefits derived by having the standards apply to those vehicles, the agency concludes that GM has misinterpreted the effects of this amendment. This amendment will reduce somewhat the compliance test requirements for those light trucks and vans with unloaded vehicle weights in excess of 5,500 pounds. It will not affect light trucks with unloaded vehicle weights below 5,500 pounds. According to agency information, approximately 25 percent of the light trucks have unloaded vehicle weights in excess of 5,500 while the remainder fall below that weight. As a result of weight reduction to improve fuel economy, it is likely that even more light trucks will fall below the 5,500 pound maximum test weight in the future. Therefore, this amendment will have no impact upon most light trucks and vans. In light of the small proportion of light trucks and vans affected by this amendment and considering the potential benefits of applying these standards to all light trucks and vans, the agency declines to adopt GM's suggestion that the standards be made inapplicable to these vehicles.

With respect to GM's question about the appropriate level of safety for light trucks, the agency's statement in the notice of proposed rulemaking was intended to show that the safety of light trucks and vans cannot be viewed without considering the relative safety of lighter vehicles

that they may impact. Accordingly, the level of safety that the agency seeks to achieve by this and other safety standards is determined by balancing the interests of the occupants of passenger cars and heavier vehicles.

GM also questioned the agency's statement that vehicle aggressivity may be increased by imposing too severe requirements on these vehicles. GM suggested that no evidence exists that vehicle aggressivity is increased as a result of complying with these standards.

The agency stated in the proposal that it was concerned that compliance with the standards as they now exist might have increased the aggressivity of the vehicles, thereby harming the occupants of passenger cars that are impacted by these larger, more rigid vehicles. The agency is now beginning to examine the full range of vehicle aggressivity problems. The docket for this notice contains a paper recently presented by a member of our staff to the Society of Automotive Engineers on this subject. The agency tentatively concludes, based upon the initial results of our research and analysis, that vehicle aggressivity could be a safety problem and that the agency considers that possibility in issuing its safety standards. The NHTSA notes that Volkswagen applauds the agency's recognition of the vehicle aggressivity factor in safety.

As to GM's argument that compliance with the standards may not have increased vehicle aggressivity, our information on this point came from the manufacturers. The manufacturers indicated that compliance with Standards 212 and 219 requires strengthening the vehicle frame. This makes a vehicle more rigid. Our analysis indicates that making a vehicle more rigid may also make it more aggressive. Therefore, the agency concludes partially on the basis of the manufacturer's information, that compliance with the safety standards as they are written may have increased the aggressivity of the vehicles.

Ford Motor Company suggested that, rather than change these two particular standards, the agency should amend the certification regulation (Part 568) to state that any vehicle that is barrier tested would be required only to comply to an unloaded vehicle weight of 5,500 pounds or less. Ford suggested that this would standardize all of the tests and provide uniformity.

The agency is unable to accept Ford's recommendation for several reasons. First, the certification regulation is an inappropriate place to put a test requirement applicable to several standards. The tests' requirements of the standards should be found in each standard. Second, the Ford recommendation would result in a reduction of the level of safety currently imposed by Standard No. 301, *Fuel System Integrity.*

As we stated earlier and in several other notices, the agency is legislatively forbidden to modify Standard No. 301 in a way that would reduce the level of safety now required by that standard. Even without this legislative mandate, the agency would not be likely to relieve the burdens imposed by Standard No. 301. That standard is extremely important for the prevention of fires during crashes. Compliance of a vehicle with this standard not only protects the occupants of the vehicle that is in compliance but also protects the occupants of vehicles that it impacts. The agency concludes that the standard now provides a satisfactory level of safety in vehicles, and NHTSA would not be likely to amend it to reduce these safety benefits even if such an amendment were possible.

With respect to fuel system integrity, several manufacturers suggested that the agency had underestimated the impact of that standard upon weight and center of gravity restrictions. These commenters indicated that compliance with that standard requires more than merely adding shielding to the fuel systems of the vehicles. The agency is aware that compliance with that standard in certain instances has imposed restrictions upon manufacturers. Nonetheless, the agency continues to believe that as a result of this amendment, the chassis manufacturers will be able to reduce their weight and center of gravity restrictions while still maintaining the compliance of their vehicles with Standard No. 301.

Chrysler commented that the agency should consider including the new test procedure in Standard No. 204 and all other standards that require barrier testing. The agency has issued a notice on Standard No. 204 (44 FR 68470) stating that it was considering a similar test provision for that standard. The agency also is aware that any barrier test requirement imposed upon vehicles subject to substantial modifications by final-stage

manufacturers will create problems for the final-stage manufacturers. Accordingly, the agency will consider the special problems of these manufacturers prior to the the issuance of standards that might affect them and will attempt to make the test requirements of the various standards consistent wherever possible.

The agency has reviewed this amendment in accordance with Executive Order 12044 and concludes that it will have no significant economic or other impact. Since the regulation relieves some testing requirements, it may slightly reduce costs associated with some vehicles. Accordingly, the agency concludes that this is not a significant amendment and a regulatory analysis is not required.

In accordance with the foregoing, Volume 49 of the Code of Federal Regulations Part 571 is amended by adding the following sentence to the end of paragraph S6.1(b) of Standard No. 212 (49 CFR 571.212) and paragraph S7.7(b) of Standard No. 219 (49 CFR 571.219).

Vehicles are tested to a maximum unloaded vehicle weight of 5,500 pounds.

The authors of this notice are William Smith of the Crashworthiness Division and Roger Tilton of the Office of Chief Counsel.

Issued on March 28, 1980.

Joan Claybrook
Administrator

45 F.R. 22044
April 3, 1980

MOTOR VEHICLE SAFETY STANDARD NO. 212

Windshield Mounting

S1. Scope. This standard establishes windshield retention requirements for motor vehicles during crashes.

S2. Purpose. The purpose of this standard is to reduce crash injuries and fatalities by providing for retention of the vehicle windshield during a crash, thereby utilizing fully the penetration-resistance and injury-avoidance properties of the windshield glazing material and preventing the ejection of occupants from the vehicle.

S3. Application. This standard applies to passenger cars and to multipurpose passenger vehicles, trucks, and buses having a gross vehicle weight rating of 10,000 pounds or less. However, it does not apply to forward control vehicles, walk-in van-type vehicles, or to open-body-type vehicles with fold-down or removable windshields.

S4. Definition. "Passive restraint system" means a system meeting the occupant crash protection requirements of S5 of Standard No. 208 by means that require no action by vehicle occupants.

S5. Requirements. When the vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, under the conditions of S6, the windshield mounting of the vehicle shall retain not less than the minimum portion of the windshield periphery specified in S5.1 and S5.2.

S5.1 Vehicles equipped with passive restraints.

Vehicles equipped with passive restraint systems shall retain not less than 50 percent of the portion of the windshield periphery on each side of the vehicle longitudinal centerline.

S5.2 Vehicles not equipped with passive restraints. Vehicles not equipped with passive restraint systems shall retain not less than 75 percent of the windshield periphery.

S6. Test conditions. The requirements of S5 shall be met under the following conditions:

S6.1 The vehicle, including test devices and instrumentation, is loaded as follows:

(a) Except as specified in S6.2, a passenger car is loaded to its unloaded vehicle weight plus its cargo and luggage capacity weight, secured in the luggage area, plus a 50th-percentile test dummy as specified in Part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208. Each dummy is restrained only by means that are installed for protection at its seating position.

(b) Except as specified in S6.2, a multipurpose passenger vehicle, truck, or bus is loaded to its unloaded vehicle weight plus 300 pounds or its rated cargo and luggage capacity, whichever is less, secured to the vehicle, plus a 50th-percentile test dummy as specified in Part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208. Each dummy is restrained only by means that are installed for protection at its seating position. The load is distributed so that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR. If the weight on any axle when the vehicle is loaded to its unloaded vehicle weight plus dummy weight exceeds the axle's proportional share of the test weight, the remaining weight is placed so that the weight on that axle remains the same. For the purposes of this section, unloaded vehicle weight does not include the weight of workperforming accessories. Vehicles are tested to a maximum unloaded vehicle weight of 5,500 pounds.

S6.2 The fuel tank is filled to any level from 90 to 95 percent of capacity.

S6.3 The parking brake is disengaged and the transmission is in neutral.

S6.4 Tires are inflated to the vehicle manufacturer's specifications.

S6.5 The windshield mounting material and all vehicle components in direct contact with the mounting material are at any temperature between 15°F and 110°F.

41 F.R. 36493
August 30, 1976

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems, Seat Belt Assemblies, and Anchorages

(Docket No. 74-9; Notice 6)

ACTION: Final rule.

SUMMARY: This rule establishes a new Standard No. 213, *Child Restraint Systems,* which applies to all types of child restraints used in motor vehicles. It also upgrades existing child restraint performance requirements by setting new performance criteria and by replacing the current static tests with dynamic sled tests that simulate vehicle crashes and use anthropomorphic child test dummies. The new standard would reduce the number of children under 5 years of age killed or injured in motor vehicle accidents.

DATES: On June 1, 1980, compliance with the requirements of this standard will become mandatory. The current Standard No. 213 is amended to permit, at the manufacturer's option, compliance during the interim period either with the requirements of existing Standard No. 213, Child Seating Systems, or the new Standard No. 213, Child Restraint Systems.

ADDRESSES: Petitions for reconsideration should refer to the docket number and be submitted to: Docket Section, Room 5108, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C.20590 (202-426-2264)

SUPPLEMENTARY INFORMATION:

This notice establishes a new Standard No. 213, *Child Restraint Systems.* A notice of proposed rulemaking was published on May 18, 1978 (43 FR 21470) proposing to upgrade and extend the applicability of the existing Standard No. 213, *Child Seating Systems.* The existing standard does not regulate car beds and infant carriers and uses static testing to assess the effectiveness of child restraint systems. The new standard covers all types of child restraint systems and evaluates their performance in dynamic sled tests with anthropomorphic test dummies. On May 18, 1978, NHTSA also published a companion notice of proposed rulemaking proposing to amend Part 572, *Anthropomorphic Test Dummies,* by specifying requirements for two anthropomorphic test dummies representing 3 year and 6 month old children (43 FR 21490) for use in compliance testing under proposed Standard No. 213. The comment closing date for both notices was December 1, 1978.

At the request of the Juvenile Product Manufacturers Association, NHTSA extended the comment closing date until January 5, 1979, for the portions of both proposals dealing with testing with the child test dummies. This extension was granted because manufacturers were reportedly having problems obtaining the proposed test dummies to conduct their own evaluations.

Consumers, public health organizations, child restraint manufacturers and others submitted comments on the proposed standard. The final rule is based on a thorough evaluation of all data obtained in NHTSA testing, data submitted in the comments, and data obtained from other pertinent documents and test reports. Significant comments submitted to the docket are addressed below. The agency will soon issue a final rule on the anthropomorphic test dummy proposal.

Summary of the Final Rule Provisions

The significant portions of the new standard are as follows:

1. The performance of the child restraint system is evaluated in dynamic tests under conditions

simulating a frontal crash of an average automobile at 30 mph. The restraint system is anchored with a lap belt and, if provided with the restraint, a supplementary anchorage belt (tether strap). An additional frontal impact test at 20 mph is conducted for restraints equipped with tether straps or arm rests. In that additional test, child restraints with tether straps will be tested with the tether straps detached and child restraints with arm rests will be tested with the arm rest in place but with the child restraint system belts unbuckled. The additional 20 mph tests are intended to ensure a minimum level of safety performance when the restraints are improperly used.

2. To protect the child, limitations are set on the amount of force exerted on the head and chest of the child test dummy during the dynamic testing of restraints specified for children over 20 pounds. Limitations are also set on the amount of frontal head and knee excursions experienced by the test dummy in forward-facing child restraints and harnesses. To prevent a child from being ejected from a rearward-facing restraint, limitations are set on the amount the seat can tip forward and on the amount of excursion experienced by the test dummy during the simulated crash.

3. During the dynamic testing, no load-bearing or other structrual part of any child restraint system shall separate so as to create jagged edges that could injure a child. If the restraint has adjustable positions, it must remain in its pre-test adjusted position during the testing so that the restraint does not shift positions in a crash and possibly injure a child's limbs caught between the shifting parts or allow a child to submarine during the crash (i.e., allow the child's body to slide too far forward and downward, legs first).

4. To prevent injuries to children during crashes from contact with the surface of the restraint, requirements for the size and shape are specified for those surfaces. In addition, protective padding requirements are set for restraints used by children weighing 20 pounds or less.

5. Requirements in Standard No. 209, *Seat Belt Assemblies* (49 CFR 571.209), are applied to the belt restraints used in child restraint systems.

6. The amount of force necessary to open belt buckles and release a child from a restraint system is specified so that children cannot unbuckle themselves, but adults can easily open the buckle.

7. To promote the easy and correct use of all child restraint systems, they are required to attach to the vehicle by means of vehicle seat belts.

8. Warnings for proper use of the restraints must be permanently posted on the restraint so that the warnings are visible when the restraint is installed. Other information, such as the height and weight limits for children using the child restraint, must also be permanently displayed on the restraint but it does not have to be visible when the restraint is installed. The restraint must also have a location for storing an accompanying information booklet or sheet on how to correctly install and use the restraint.

9. A standard seat assembly is used in the dynamic testing to represent the typical vehicle bench seat and thereby aboid the cost of testing child restraints on numerous vehicle seats.

Applicability of Standard No. 213

The provisions of new Standard No. 213 apply to all types of child restraints used in motor vehicles for protection of children weighing up to 50 pounds, such as child seats, infant carriers, child harnesses and car beds. Beginning on June 1, 1980, compliance with the requirements of this standard will become mandatory. The current Standard No. 213 is amended to permit, at the manufacturer's option, compliance during the interim period either with the requirements of existing Standard No. 213, Child Seating Systems, or of the new Standard No. 213, Child Restraint Systems.

Dynamic Testing

The requirements to be met in the dynamic testing of child restraints include: maintaining the structural integrity of the system, retaining the head and knees of the dummy within specified excursion limits (i.e., limits on how far those portions of the body may move forward) and limiting the forces exerted on the dummy by the restraint system. These requirements will reduce the likelihood that the child using a child restraint system will be injured by the collapse or disintegration of the system, or by contact with interior of the vehicle, or by imposition of intolerable forces by the restraint system. As explained below, omission of any of these three requirements would render imcomplete the criteria for the quantitative assessment of the safety of a child restraint system

and could very well lead to the design and use of unsafe restraints.

It was suggested in comments by the child restraint manufacturers and their trade association, the Juvenile Products Manufacturers Association (JPMA), that available restraints are performing satisfactorily. According to them, the new standard imposes expensive testing requirements with instrumented dummies which will increase the price of child restraints and discourage the purchasing of child restraints because of their increased costs. Many manufacturers suggested that the agency limit the standard to tests for occupant excursion and restraint system structural integrity in dynamic tests and not require the use of instrumented test dummies to measure crash forces imposed upon a child.

NHTSA recognizes that some child restraints perform relatively well, but the agency's testing has shown that others perform unsatisfactorily. Measuring only the structural integrity of the system and the amount of occupant excursion allowed during the testing does not provide a measurement of the severity of forces imposed on a child during a crash and thus does not provide an accurate assessment of the actual safety of the system. For example, a manufacturer could design a restraint with a surface mounted in front of the child that would allow a small amount of occupant excursion. However, that surface could impose potentially injurious forces on a child. NHTSA believes that the force measurement performance requirements are a crucial and necessary test to adequately judge a restraint system's effectiveness in preventing or reducing injuries. The use of instrumented test dummies and force measurement requirements are crucial elements of Standard No. 208, *Occupant Crash Protection,* which establish performance requirements for automatic restraint systems. NHTSA believes that systems designed specifically for children should have to provide the same high degree of occupant protection.

Several manufacturers (GM, Ford, Questor, and others) and JPMA objected to the proposed head and chest acceleration limits that must not be exceeded in the dynamic testing. They argued that the acceleration limits are based on biomechanical data for adults and there are no data showing their applicability to children. Because of the lack of biomechanical data on children's tolerance to impact forces, NHTSA has conducted tests of child restraints with live primates to serve as surrogates for three-year-old children. Primates are similar in certain respects to children and, have been used by GM, Ford and others as surrogates in child restraint testing to assess protential injuries to children in crashes. In simulated 30 mph crashes conducted for NHTSA, similar to the test prescribed in the proposed standard, the primates either were not injured or sustained only minor injuries. NHTSA has also conducted child restraint tests using instrumented test dummies representing three-year-old children instead of primates. In the tests, the forces measured on the test dummies, which had not been injurious to the primates, did not exceed the head and chest acceleration criteria proposed in the standard. NHTSA is thus confident that the child restraints which do not exceed these performance criteria in the prescribed tests should prevent or reduce injuries to children in crashes.

Use of instrumented test dummies should not unduly raise the price of child restraints. Since many child restraint systems are already close to compliance, the cost per restraint of any needed design and testing costs should be minimal.

The May 1978 notice would have required restraint systems with adjustable positions to meet the performance requirements of the standards in any of its adjusted positions recommended for use in a motor vehicle. The restraint would have had to remain in its adjusted position during testing. International Manufacturing Co. requested the agency to test adjustable restraints in only their extreme up and down positions. If a manufacturer chooses to offer a seat with a number of adjustable positions which it recommends for use in a motor vehicle, it is important that the seat meet the performance requirements of the standard at any of those positions. Therefore, International's request is denied. NHTSA urges manufacturers not to include any adjustment positions for their restraints which are not to be used in a motor vehicle.

Strollee, Questor and Volvo asked NHTSA to allow adjustable position restraints to change positions during the testing, arguing that controlled change of position can be an effective energy-absorbing method. Allowing changes from one adjustment position to another during a crash can cause injuries to children's hands or fingers caught between the structural elements of the restraint as

it changes position. Other effective energy-absorbing methods are available which will not pose a risk of injury to children. Thus, NHTSA is not adopting this suggestion.

Child restraint manufacturers and other interested parties, such as Action for Child Transportation Safety (ACTS), American Academy of Pediatrics, Physicians for Automotive Safety, and Michigan's Office of Highway Safety, urged NHTSA to lengthen the 30 inch head and knee excursion requirements for forward-facing restraints. They argued that some child restraint systems which have been effective in real world crashes will exceed the proposed head excursion limit. NHTSA has reviewed its child restraint tests and determined that during the last few inches of excursion the remaining velocity of the head in impacts with padded surfaces is relatively low. Because slightly increasing the head excursion should not increase the forces imposed upon the child's head, the head excursion limit is changed from 30 to 32 inches.

The May 1978 notice proposed limiting the amount of knee excursion in forward-facing child restraints to 30 inches. The purpose of the knee excursion limit is to prevent manufacturers from controlling the amount of head excursion by designing their restraints so that their occupants submarine excessively during a crash (i.e., so that their bodies slide too far downward and forward, legs first). Many child restraint manufacturers and JPMA asked the agency to lengthen the knee excursion limits. They argued that many restraints, particularly reclining child restraints where the occupant's knees will be further forward than a non-reclining child restraint, cannot pass the knee excursion limit, but do not allow the occupants to submarine. They claimed that the reclining feature is a comfort and convenience device which promotes seat usage since it allows a child to sleep in the restraint. They recommended that the agency establish a separate requirement which would prevent the occupant's torso from straightening out and submarining under the belts. NHTSA has tested several child restraints in the reclining position and determined that the knee excursion can be lengthened to 36 inches without allowing submarining if the dummy's torso has rotated at least 15 degrees forward from its initial starting position when the knees have reached their maximum excursion. Thus, the new standard incorporates a 36 inch knee excursion limit and requires the test dummy's torso to have rotated at least 15 degrees forward when the knees have reached their maximum excursion.

For rear-facing child restraints (i.e., infant carriers) the May 1978 notice proposed retaining the dummy's head within the confines of the seat and preventing the back support surface of the restraint from tipping forward far enough to allow the angle between it and the vertical to exceed 60 degrees. If the support surface were allowed to tip more, the infant in the restraint could slide head first out of the shoulder straps. GM and Heinrich Von Wimmersperg pointed out that there is a conflict between the description of the confines of rear-facing restraints contained in the text of the standard and the manner in which the confines are defined in one of the figures incorporated in the standard. The text has been modified to correctly identify the confines of the restraint systems. GM also commented that the text of the standard defined the head confinement requirements in reference to the head target points of the infant dummy, although the infant dummy, unlike the 3 year child test dummy, does not have target points. The revised specifications for the infant test dummy do include head target points and therefore the confinement requirement is retained as originally proposed.

Several child restraint manufacturers objected to limiting the forward tipping of rear-facing restraints to 60 degrees. They argued that rear-facing child restraints can tip as much as 70 degrees forward and still retain the child within the restraint. They also argued that a rear-facing restraint will hit the instrument panel in the front seat, or the back of the front seat if the restraint is used in the rear seat, before the restraint tips 60 degrees. NHTSA is retaining a limit on forward tipping since a child restraint can be used in a vehicle with the vehicle's front seat moved to its extreme forward or rearward position. If the child restraint is used in the front seat and the vehicle seat is in the extreme rearward position, the child restraint can tip forward without striking the instrument panel. Likewise, a child restraint used in the rear seat, where the vehicle's front seat is in its extreme forward position, can tip forward without striking the back of the front seat. However, tests done by NHTSA have shown that a restraint can tip forward as much as 70 degrees

while still retaining the child within the confines of the restraint. Therefore, the limitation on forward tipping is being changed to 70 rather than 60 degrees.

One child restraint manufacturer, the American Association for Automotive Medicine and Heinrich Von Wimmersperg commented that manufacturers of rear-facing restraints may attempt to comply with the limitation on forward rotation by designing the normal resting angle of the seat in a very vertical alignment or by adding attachments to prop the seat into a vertical position. Either of those approaches can create an uncomfortable seating position for the child. They recommended that the agency establish a minimum resting angle for rear-facing restraints. The agency is not adopting this suggestion at this time. By increasing the amount of forward rotation allowed, the agency should have removed the temptation for manufacturers to design restraint resting angles which would make it easier to comply with the requirement, but would create uncomfortable seating positions for the child.

The May 1978 notice proposed an additional dynamic test at 20 mph for child restraint systems equipped with tether straps with those straps left unattached. A number of commenters (such as Insurance Institute for Highway Safety, ACTS, University of Tennessee, Questor, Bobby Mac, and Michigan's Office of Highway Safety) commented that many people fail to connect the tether. They recommended that this type of restraint be tested at 30 mph with unattached tethers.

The agency is aware of the benefits and disadvantages of child restraints equipped with tethers, which presently account for over 70 percent of the child restraint sales. The agency's testing has shown that in 30 mph frontal tests child restraints with the tethers attached have less occupant excursion and lower head and chest accelerations than shield-type restraints that do not use tethers. Tethered restraints also allow far less occupant excursion in lateral crashes than shield-type restraints. The available accident data on child restraints, which includes consumer letters and accident investigation reports, is limited since the usage of child restraints is low. It does show, however, that tethered restraints, both properly tethered and untethered, have prevented injuries to children in crashes where other vehicle occupants were severely injured.

Because of the performance of properly tethered child restraints under testing and accident conditions, the agency does not want to eliminate those restraints from the market. At the same time, the agency wants to reduce or eliminate the possibility of people not using the tethers that accompany those restraints. Therefore, the agency is requiring all seats equipped with a tether to have a visible label warning people to correctly fasten the tether. In addition, the agency is considering issuing a proposal to require vehicle manufacturers to provide attachments for tether anchorages in all their vehicles. Having such attachments will enable parents to easily and properly attach tethers. The agency is also striving to promote the increased and proper use of child restraints through educational programs. As a part of this effort, NHTSA has conducted a series of regional seminars aimed at helping grass roots organizations educate parents about the importance of child restraints. A NHTSA-sponsored national conference on child restraint safety is scheduled for December 10–12 in Washington, D.C. to further these educational programs.

To ensure that restraints equipped with tethers provide at least a minimum level of protection if they are misused, the agency will require an additional dynamic test at 20 mph for those restraints. When tested with tethers unattached, the restraints must pass all the dynamic test performance requirements of the standard.

Energy Absorption and Distribution

Several manufacturers (Questor, Strollee, Cosco) and JPMA objected to the proposed height requirements for head restraints used to control the rearward movement of a child's head in a crash. The proposal would have slightly increased the requirements currently set in Standard No. 213. They argued that there was no basis for the change, which would require them to redesign their child restraints. The new requirements are based on anthropometric data on children gathered since the standard was originally adopted. NHTSA proposed the new head restraint height requirements in its earlier March 1974 notice of proposed rulemaking on child restraints and many manufacturers have already redesigned their seats to comply with the requirements. Since the new heights more accurately reflect the seating heights of children than the old requirements, the agency

is adopting them as proposed. The notice proposed that the top of the head restraint be 22 inches above the seating surface for restraints used by children weighing more than 40 pounds. Questor requested the upper weight be changed to 43 pounds. Since 40 pounds represents the weight of a 50th percentile 5 year old and 23 inches represents its seating height, the requirement is not changed.

Several manufacturers (Cosco, Strollee, Questor) and JPMA raised objections to the proposed requirement that head restraints of child restraint systems have a width of not less than 8 inches. They pointed out that the minimum head restraint width requirement is intended to prevent a child's head from going beyond the width of a head restraint in a lateral or rear impact. They argued that restraints with side supports or "wings" should not have to meet the 8 inch width requirement since the side supports will prevent an occupant's head from moving laterally outside the restraint system. NHTSA agrees that the side supports should help laterally retain the child's head within the restraint during a side or rear impact and therefore is exempting those restraints from the 8 inch minimim width requirement. However, to ensure that child restraints with side supports have sufficient width to accommodate the heads of the largest child using the restraint, the agency has set a 6 inch minimum width for those restraints. In addition, to ensure that side supports are large enough to retain an occupant's head within the restraint, the agency has set a minimum depth requirement of four inches for those supports. Anthropomorphic data show that the head of a 50th percentile 5 year old child measures 7 inches front to rear and is 6 inches in breadth. Therefore, a four inch support should contact a sufficient area of the child's head to restrain it.

Manufacturers also questioned if the 8 inch width requirements is to be measured in restraints with side support from the surface of the padded side support or from the surface of the underlying structure before the padding is added. The wording of the standard is changed to make clear that the distance is measured from the surface of the padding, since the padded surface must be wide enough to accommodate the child's head.

The notice proposed that the minimum head restraint height requirement would not apply to restraints that use the vehicle's seat back to restrain the head, if the target point on the side of the head of the test dummy representing a 3 year old child is raised above the top of the seat back. Ford said that because of permitted differences in the dimensions of different test dummies and test seats, its child restraint will not consistently meet the requirements. Ford asked that the height requirement be changed or the manufacturers be permitted to restrict their restraints to seats with head restraints or to rear seats which have a flat surface immediately behind the seat. The standard allows a manufacturer to specify in its instruction manual accompanying the restraints which seating locations cannot be used with the child restraint. Therefore, no change is necessary, since Ford is allowed to restrict use of its restraint.

Several manufacturers (Cosco, Strollee, Questor) and JPMA objected to the proposed force distribution requirement set for the sides of child restraint systems. The specifications do not require manufacturers to incorporate side supports in their restraints, they only regulate the surfaces that the manufacturer decides to provide so that they distribute crash forces over the child's torso. The commenters requested that the agency define the term "torso" and explain the reason for setting different side support requirements for systems used by infants weighing less than 20 pounds than for systems used by children weighing 20 pounds or more. In restraints for infants less than 20 pounds, the minimum side surface area requirements are based on anthropometric data for a 6-month-old 50th percentile infant to ensure maximum lateral body contact in a side impact. Since the skeletal structure of an infant is just beginning to develop, it is important to distribute impact forces over as large a surface area of the child as possible, rather than concentrating the potentially injurious forces over a small area. For restraints used by children weighing more than 20 pounds and, therefore, having a more developed skeletal structure the minimum surface area requirement is based on anthropometric data for a 50th percentile 3-year-old child to provide restraint for the shoulder and hip areas of the child.

To enable manufacturers to determine their compliance with the torso support requirement, the standard follows the dictionary definition of

"torso" and defines the term as referring to the portion of the body of a seated anthropomorphic test dummy, excluding the thighs, that lies between the top of the seating surface and the top of the shoulders of the test dummy.

Several manufacturers (Cosco, Strollee, Questor) and JPMA questioned the basis for prohibiting surfaces with a radius of curvature of less than 3 inches. They and Hamill also asked if the measurement of the curvature is to be made before or after application of foam padding on the underlying surface. The radius of curvature limitation will prevent sharp surfaces that might concentrate potentially injurious forces on the child. It is based on the performance of systems with such a radius of curvature that have not produced injuries in real world crashes. The standard is changed to require the measurement of the radius of curvature to be made on the underlying structure of the restraint, before application of foam padding. Since foam compresses when impacted in a crash, it is important that the structure under the foam be sufficiently curved so it does not concentrate the crash forces on a limited area of the child's body.

For child restraints used by children weighing less than 20 pounds, the notice proposed that surfaces which can be contacted by the test dummy's head during dynamic testing must be padded with a material that meets certain thickness and static compression requirements. A number of manufacturers (Strollee, Cosco, GM and Questor) and JPMA questioned the specifications set for the padding, arguing that there is no need to change from the current materials and the specification of a minimum thickness is design restrictive. Other commenters (Bobby-Mac, Hamill and American Association for Automotive Medicine) requested that the agency establish a test to measure the energy-absorbing capabilities of the underlying structure of the restraint, as well as of the padding.

NHTSA eventually wants to establish dynamic test requirements using instrumented test dummies for restraints used by children weighing 20 pounds or less. Such testing would measure the total energy absorption capability of the padding and underlying structure. At present, there are no instrumented infant test dummies, so the agency is instead specifying long-established static tests of the padding material.

In response to manufacturer comments, the NHTSA has reevaluated the materials currently used in child restraints and determined that those and other widely available materials can apparently provide sufficient energy absorption if used with a specified thickness. The agency has changed the proposed compression-deflection requirements to allow the use of a wider range of materials which should enable manufacturers to provide protective padding for children without having to increase the price of the restraint.

The proposed ban on components, such as arm rests, directly in front of a child which do not restrain the child was objected to by JPMA, and some manufacturers (Strollee, Century Products, International Manufacturing). They argued that arm restraints should not be banned since they promote usage of a child restraint by giving the child an area to rest against or place a book or other plaything. Other manufacturers (Hamill, Bobby-Mac), Michigan's Office of Highway Safety, and the American Academy of Pediatrics supported the ban arguing that arm rests promote misuse by creating the impression that a child can be adequately restrained by merely placing the arm rest in front of the child. The agency is concerned that parents' mistaken beliefs about the protective capability of arm rests may mislead them into not using the harness systems in the restraints.

Therefore, such arm rests or other components only may be installed if they provide adequate protection to a child when the restraint is misused in a foreseeable way because of the presence of the arm rest (i.e., the child is not buckled into the harness that comes with the child restraint system). To measure the performance of child restraints with arm rests and other devices that flip down in front of the child, those restraints will be tested at 20 mph with the component placed in front of the child, but without the child strapped into the restraint system. The restraint must pass the occupant excursion and other dynamic performance requirements in that condition.

Child Restraint Belt Systems

The May 1978 notice proposed three alternatives for the buckle release force required for the harnesses that restrain a child within the restraint. Many manufacturers favored the alternative based on the current Standard No. 213 which establishes a maximum force of 20 pounds, but does not

establish a minimum force. In order to promote international harmonization, Volvo endorsed another alternative proposed by the Economic Commission of Europe which would set a minimum force of 2.25 pounds and a maximum of 13.45 pounds. However, Volvo proposed deviating from the ECE proposal and allowing a maximum release force of 20 pounds. Michigan's Office of Highway Safety and the American Seat Belt Council (ASBC) supported the other alternative which, based on a study by the National Swedish Road and Traffic Institute, would have set a 12 pound minimum force and a 20 pound maximum force. ASBC stated that this alternative should prevent a small child from opening the buckle, but not be too strong to prevent a small adult female from opening the buckle. Other commenters, such as ACTS and Borgess Hospital, recommended that the force be set at a level which children could not manage. Borgess noted that their experience with 400 rental child restraints shows that keeping children from unbuckling their restraints is a common problem. Physicians for Automotive Safety recommended that all buckle types be standardized and the release force be set at a level which can be quickly opened in an emergency.

Based on its review of the comments, NHTSA has decided to require buckles with a minimum release force of 12 pounds and a maximum release force of 20 pounds. The effectiveness of a restraint depends on the child being properly buckled at the time of impact. If a child is capable of releasing the buckle, it can inadvertently or purposely defeat the protection of the harness system. Setting a minimum force of 12 pounds should prevent small children from opening the buckle. Setting a maximum of 20 pounds as the release force will enable parents to easily open the buckle. NHTSA encourages manufacturers of child restraints to use push button buckles, similar to those used in automobile belts, so that people unfamiliar with child restraints can readily unbuckle them in emergencies. The agency will consider further rulemaking to standardize the buckle if manufacturers do not voluntarily adopt this approach.

Likewise, NHTSA has already advised child restraint manufacturers that physicians have informed the agency that some children are burned during the summer by over-heated metal buckles or other metal child restraint hardware. NHTSA will monitor manufacturer efforts to eliminate this problem and determine if additional rulemaking is necessary.

The proposal that the belt systems in child restraints meet many of the belt and buckle requirements of Standard No. 209, *Seat Belt Assemblies,* such as those relating to abrasion, resistance to light, resistance to microorganisms, color fastness and corrosion and temperature resistance was not opposed by any of the commenters and is therefore adopted. The buckle release test in Standard No. 209 for child restraint buckles is deleted, since Standard 213 now sets new performance requirements for buckles. Ford noted that the proposal inadvertently dropped a portion of Standard No. 209's abrasion requirements, which have been reincorporated in the final rule.

To prevent the belts from concentrating crash forces over a narrow area of a child's body, the proposal sets a minimum belt width of 1½ inch for any belt that contacts the test dummy during the testings. Hamill requested that pieces of webbing used to position the principal belts that maintain crash loads be exempt from the minimum width requirements. The agency believes that as long as the test dummy, and thus a child, can contact the belts during a crash the belts should be wide enough to spread the crash forces and therefore Hamill's request is denied.

Methods of Installation

Many commenters, including ACTS, American Academy for Pediatrics, Insurance Institute for Highway Safety, and American Seat Belt Council, said that child restraint systems cannot be used with some automatic belt systems, since they do not have a lap belt to secure the child restraint to the seat. They asked the agency to require all automatic belt systems to include lap belts.

The agency considers the compatibility of child restraints with automatic belt systems to be an important issue. One of the purposes of the agency's December 12, 1979, public meeting on child safety and motor vehicles is to obtain the public's views and information on that and other child passenger safety issues to assist the agency in determining whether to commence rulemaking. One rulemaking option currently being considered by the agency is to require vehicle manufacturers to provide anchorages for lap belts in automatic restraint equipped vehicles so that parents wishing to install lap belts can easily do so.

A number of manufacturers are voluntarily taking steps to make automatic belt systems compatible with child restraint systems. For example, GM provides an additional manual belt with its optional automatic lap-shoulder belt system for the front passenger's seat in the 1980 model Chevrolet Chevette to enable parents to secure child restraint systems.

Many of the commenters also asked the agency to require vehicle manufacturers to install anchorages or provide predrilled holes to attach tether anchorages in all their vehicles. They argued such anchorages or holes will make it easy for parents to attach tether straps correctly. As mentioned earlier in this notice, the agency is considering issuing a proposal to require manufacturers to provide attachments for tether anchorages in all their vehicles.

The May 1978 notice proposed that all child restraints be capable of being secured to the vehicle seat by a lap belt. Volvo and Mercedes once again asked the agency to allow the use of "vehicle specific" child restraints (systems uniquely designed for installation in a particular make and model which do not utilize vehicle seat belts for anchorages). As explained in the May 1978 notice, such systems can easily be misused by being placed in vehicles for which they were not specifically designed. Standardizing all restraints by requiring them to be capable of being attached by a lap belt is an important way to prevent misuse.

However, since vehicle specific child restraints can provide adequate levels of protection when installed correctly, NHTSA is not prohibiting the manufacture of such devices. The new standard requires them to meet the performance requirements of the standard when secured by a vehicle lap belt. As long as child restraints can pass the performance requirements of the standard secured only by a lap belt, a manufacturer is free to specify other "vehicle specific" installation conditions.

Labeling

The requirement for having a visible label permanently mounted to the restraint to encourage proper use of child restraints was supported by many of the commenters, including the Center for Auto Safety, ACTS, Insurance Institute for Highway Safety, and Michigan's Office of Highway Safety. Several manufacturers (Century, Cosco, Questor) objected to having a visible label on child restraints, claming that there is not enough space on some restraints to place all the required information. Other commenters supported the visible labeling requirement but suggested that the visible label only have a single warning telling people to follow the manufacturer's instructions (American Association for Automotive Medicine, Strollee, Hamill). Others suggested placing warnings about the correct use of the restraint on a visible label and placing such information as the height and weight limits for children using the restraint and the manufacturer's certification that it meets all Federal Motor Vehicle Safety Standards on a nonvisible label (GM, PAS).

After reviewing the comments, NHTSA concludes that it is important to have certain warnings in a visible position to serve as a constant reminder on how to correctly use the restraint. Because of the limited space on some restraints, the agency has shortened the labeling requirements to require only those instructions most directly concerned with the safe use of the seat be visible. Thus, depending on its design, the restraint must warn parents to secure the restraint with the vehicle lap belt, snugly adjust all belts provided with the restraint, correctly attach the top tether strap and only use a restraint adjustment position which are intended for use in a motor vehicle.

In response to the agency's request for other instructions that a manufacturer should give parents, several commenters (ACTS, Michigan's Office of Highway Safety, Borgess Hospital) said that a warning on the label is necessary to prevent misuse of infant carriers. They said many people mistakenly place infant carriers in a forward-facing, rather than a rear-facing position. A forward-facing position defeats the purpose of those restraints which are designed to spread the forces of the crash over the infant's back. Because of the importance of preventing this type of misuse, the agency will require the visible label to also remind parents not to use rear-facing infant restraints in any other position.

Information about the height and weight limits of the children for which the restraint is designed, the manufacturer and model of the child restraint, and the month, year and place of manufacture and the certification that the restraint complies with all applicable Federal Motor Vehicle Safety Standards would also have to be provided, but that information does not have to be on a label that is visible when the seat is installed.

Many commenters (GM, Insurance Institute for Highway Safety, Multnomah County Department of Human Services, Physicians for Automotive Safety, Center for Auto Safety, and American Academy of Pediatrics) supported the proposed requirement that manufacturers inform consumers about the primary consequences of not following the manufacturer's warning about the correct use of the restraint. Therefore, the visible label must state the primary consequence of misusing the restraint. The same information would also have to be included in the instruction manual accompanying the restraint.

Ford objected to the requirement that the label have a diagram showing the child restraint installed in a vehicle as specified in the manufacturer's instructions. It said that because of the complexity of the instructions required for proper installation of a restraint with different types of belt systems, it is not practical to place all of the information on a single label. Hamill suggested that because of those same considerations, the agency should only require the diagram to show the proper installation of the restraint at one seating position. Other commenters, such as the American Academy for Pediatrics, supported the use of diagrams on the restraint noting that diagrams can more easily convey information than written instructions.

To promote the correct use of child restraints, NHTSA believes that it is important to have a diagram on the restraint to remind users of the proper method of installation. However, so that the label does not become too unwieldy, the agency will only require manufacturers to provide a diagram showing the restraint correctly installed in the right front seating position with a continuous loop lap/shoulder belt and in the center rear seating position installed with a lap belt. For restraints equipped with top tethers, the diagram must show the tethers correctly attached in both seating positions. It is important to show the correct use of a child restraint with a continuous loop lap/shoulder belt (a type of belt system used on many current cars) since such belts must have a locking clip installed on the belt to safely secure the child restraint.

GM objected to the requirement that the label be in block type, which it said makes the label difficult to read. GM requested that manufacturers be allowed to use 10 point type with either capitals or upper and lower case lettering. GM said that using such type will result in an easier to read label which, in turn, should promote more complete reading of the label by the consumer. Since the type sought by GM should promote the reading of the label, the agency is changing the requirement to allow the use of such type as an option.

Several organizations (ACTS, Center for Auto Safety and Insurance Institute for Highway Safety) asked the agency to establish performance test to accompany the requirement that the label be permanently affixed to the restraint. They pointed out that some current paper labels peel off after the restraint has been used awhile. NHTSA has not conducted the necessary testing to establish such a requirement. NHTSA urges manufacturers, whenever possible, to mold the label into the surface of the restraint rather than use a paper label.

Consumers Union and the Center for Auto Safety suggested that all restraints be graded based on their performance in frontal and lateral crash tests and the grades be posted on all the packaging, labels, and instruction manuals accompanying the child restraint. The grades would indicate the seating position within the vehicle with which the restraint can be safely used. Neither Consumers Union nor the Center suggested any performance requirements for establishing the different grades. Since the proposed grading system is outside of the scope of the proposed rule and the agency has not done the necessary testing to determine the specific tests and performance requirements necessary to establish such grading system, NHTSA will evaluate the suggestion for use in future rulemaking.

Installation Instructions

The May 1978 notice proposed that each restraint be accompanied by instructions for correctly installing the restraint in any passenger seat in motor vehicles. Many commenters (Center for Auto Safety, Borgess and Rainbow Hospitals, University of Tennessee And ACTS) suggested that the requirement for the instructions to accompany the restraint should be more explicit to require the restraint to have a storage location, such as a slot in the restraint or a plastic pouch affixed to the restraint, for permanently storing the instructions. They point out that storing the

instructions with the restraint means they will be available for ready reference and will be passed on to subsequent owners of the restraint. NHTSA believes such a requirement would best carry out its intent to require the instructions to be easily available to all users and therefore the suggestion is adopted.

Several manufacturers (Strollee, Cosco) and JPMA objected to the agency's proposed requirement that the instructions state that the center rear seating position is the safest seating position in a vehicle. While not questioning the validity of the accident data showing the center rear seat to be the safest seating position in most vehicles, they argued that the agency should consider the psychological impact of not having the child near the adult. Accident data have consistently shown that the occupants in the rear seat are safer than occupants in the front seat. The same data show that the center rear seating position is the safest seating position in the rear seat. To enable parents to make an informed judgment about how best to protect their children, NHTSA believes that it is important to clearly inform them about the safest seating positions in the vehicle, and is therefore retaining the requirement.

In response to the agency's request for additional suggestions to be included in the instruction manual accompanying the restraint, ACTS suggested that car bed manufacturers informed consumers that the child should be placed with its head near the center of the vehicle. Because orienting a child's head in that way will ensure that it is the maximum distance away from the sides of the vehicle in a side impact, the agency has adopted ACTS suggestion. Tennessee's Office of Urban and Federal Affairs suggested that users should be told to secure child restraints with a vehicle belt when the child restraint is in the vehicle but not in use. Since an unsecured child restraint can become a flying missile in a crash and injure other vehicle occupants, the agency has adopted Tennessee's suggestion.

Test Conditions

The standard specifies requirements for a test assembly representing a vehicle bench seat to be used in the dynamic testing. Bobby-Mac commented that the test seat has a more level seating surface and less support at the forward edge of the seat than the seats in many current cars. These differences mean that a child restraint may experience more excursion on the test seat than on more angled and firmer car seats, Bobby-Mac said. NHTSA agrees that in comparison to some vehicles seats, the test seat may present more demanding test conditions. However, the test seat is representative of many seats used in vehicles currently on the road. Meeting the performance requirement of the standard on the test seat will ensure that child restraints perform adequately on the variety of different seats found in cars on the road.

Several manufacturers (Cosco and Strollee) and JPMA raised questions about the requirement proposed for the crash pulse (i.e., the amount of test sled deceleration required to simulate the crash forces experienced by a car) for the 20 and 30 mph tests. The agency had proposed a range of sled test pulses to allow manufacturers the option of using pneumatic or impact sled testing machines. Since a variety of different sled test pulses would be permitted under the proposal, manufacturers asked the agency to explain what would happen if they and the agency tested a child restraint system using different sled test pulses and produced inconsistent results (i.e., a failure using one pulse and a pass at the other, when both pulses were within the permissible range). JPMA suggested that the agency should consider a restraint as in compliance if the restraint meets all the applicable performance requirements in a test in which the sled test pulse lies entirely within the proposed range.

To provide manufacturers with the certainty they desire, the agency has redefined the sled test pulse requirement to establish a single 20 mph (Figure 3) and a single 30 mph (Figure 2) sled test pulse. Thus, in conducting its compliance testing, NHTSA may not exceed the sled test pulse set for the 20 and 30 mph tests. The sled test pulses chosen by NHTSA are the least severe pulses that meet the acceleration thresholds proposed in the notice of proposed rulemaking. Manufacturers are free to use other sled pulses, as long as the acceleration/time curve of the sled test pulse used is equal to or greater than the acceleration/time curve of the sled test pulse set in the standard.

In response to comments by Ford and others that the durability of the foam used in the standard seat assembly may influence the test results, the agency has changed the standard to specify that the foam in the test seat be changed after each test.

GM pointed out that the instructions for positioning the test dummy within the restraint did not specify when in the positioning sequences any of the restraint's belts should be placed on the test dummy. An appropriate change has been made to specify when the belts should be attached. Ford said that the dummy positioning requirements result in an "unnatural" positioning of the dummy within its Tot-Guard restraint so that the dummy's arms rest on the side of the restraint rather than with its arms on the padded portion of the shield. NHTSA notes that a child in a real-world accident will not necessarily have its arms resting on the shield. Allowing the test dummy's arm to be positioned on the shield may inhibit the dummy's forward movement and make it easier to comply with the limits on test dummy excursion and acceleration set in the standard. Thus, Ford's requested change in the positioning requirements is rejected.

Flammability

The notice proposed requiring child restraints to meet the burn resistance requirements of Standard No. 302, *Flammability of Interior Materials*. The requirement was supported by GM, the American Academy of Pediatrics and the American Seat Belt Council. No commenters opposed the requirement. In supporting the requirement, GM said that the flammability characteristics of child restraints, "which are in close proximity to an occupant," should be "compatible with the flammability characteristics of other parts of the vehicle occupant compartment interior," which already must meet the performance requirements of Standard No. 302. The agency agrees with GM about the desirability of providing all vehicle occupants with the protection of Standard No. 302 and is thus requiring all child restraints to meet the performance requirements of that standard.

Inertial Reels

Several commenters raised questions about the effectiveness of vehicle seat belts equipped with inertial reels in securing child restraints. The American Academy of Pediatrics requested the agency to restrict the use of inertial reels to the driver's seating position. Physicians for Automotive Safety and ACTS pointed out that continuous loop lap/shoulder belts with inertial reels must be used with locking clips to secure a child restraint. They said that the difficulty of installing such clips deters their use.

Agency research has found that use of inertial reels increases the comfort and convenience of seat belts and thus promotes their use by older children and adults. Thus, the agency will continue to require the use of inertial reels in vehicle belt systems. However, to ensure that inertial reels are compatible with child restraints, the agency will soon begin rulemaking on the comfort and convenience of vehicle belt systems to require that the belts used in the front right outboard seating position have a manual locking device. This requirement will mean that continuous loop and other types of inertial reel belt systems can be easily and effectively used with child restraints. Such manual locking devices will also be permitted with belts used in the rear seats. As previously outlined in this notice, the agency has established several labeling and installation instruction requirements which deal specifically with the correct use of locking clips on continuous loop belts with inertial reels. Those requirements should reduce or eliminate problems associated with using child restraint in current vehicles equipped with inertial reels.

Costs and Benefits

The agency has considered the economic and other impacts of this final rule and determined that this rule is not significant within the meaning of Executive Order 12044 and the Department of Transportation's policies and procedures implementing that order. The agency's assessment of the benefits and economic consequences of this final rule are contained in a regulatory evaluation which has been placed in the docket. Copies of that regulatory evaluation can be obtained by writing NHTSA's docket section, at the address given in the beginning of this notice.

In the 0 to 5 age group, more than 800 children are killed and more than 100,000 children are injured annually as occupants of motor vehicles. Because of the large difference in effectiveness between restraints that can pass the dynamic test of the new standard and those which have passed only a static test, NHTSA projects that there should be 43 fewer deaths and 6,528 fewer injuries per year. Because many restraints have already been upgraded in response to the agency's prior rulemaking proposal, some of the death and injury

prevention benefits of the standard have already been realized.

The projected benefits of this standard are limited by the existing low rate of child restraint use. However, the labeling and instruction requirements of this standard should increase the proper usage of child restraints.

Because of NHTSA's 1974 proposal to upgrade child restraints, many manufacturers have currently designed their restraints to meet dynamic test requirements. Therefore, those restraints are only projected to increase in price by approximately $1.00 in order to meet the other requirements of this standard. Restraints that do not currently pass dynamic tests would have a price increase of $16.00 to meet the new requirements. The average sales weighted price increase is $4.25.

Numerous commenters (including National Safety Council, American Academy of Pediatricians, Tennessee Office of Child Development and North Dakota's Department of Public Health) urged the agency to make the standard effective before the proposed May 1, 1980, effective date. GM and the American Safety Belt Council requested that the effective date be delayed beyond the proposed May 1, 1980. Many manufacturers have already upgraded their restraints to the performance requirements set in this rule. The agency believes that providing six months lead-time, until June 1, 1980, will provide sufficient time for the remaining manufacturers to upgrade their restraints.

The principal authors of this notice are Vladislav Radovich, Office of Vehicle Safety Standards, and Stephen Oesch, Office of Chief Counsel.

Issued on December 5, 1979.

Joan Claybrook
Administrator,

44 F.R. 72131
December 13, 1979

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems; Seat Belt Assemblies

(Docket No. 74-9; Notice 7)

ACTION: Response to petitions for reconsideration.

SUMMARY: This notice responds to five petitions for reconsideration and petitions for rulemaking concerning Standard No. 213, *Child Restraint Systems*. In response to the petitions, the agency is changing the labeling requirements to permit the use of alternative language, modifying the minimum radius of curvature requirement for restraint system surfaces and extending the effective date of the standard from June 1, 1980, to January 1, 1981. In addition, several typographic errors are corrected in Standard No. 209, *Seat Belt Assemblies*.

EFFECTIVE DATE: The amendments are effective on May 1, 1980. The effective date of the standard is changed from June 1, 1980, to January 1, 1981.

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich,
Office of Vehicle Standards,
National Highway Traffic Safety Administration
Washington, D.C. 20590 (202-426-2264)

SUPPLEMENTARY INFORMATION: On December 13, 1979, NHTSA published in the FEDERAL REGISTER a final rule establishing Standard No. 213, *Child Restraint Systems*, and making certain amendments to Standard No. 209, *Seat Belt Assemblies and Anchorages*. Subsequently, petitions for reconsideration were timely filed with the agency by Cosco, General Motors, Juvenile Products Manufacturers Association, and Strolee. Subsequent to the time for filing petitions for reconsideration, Strolee also filed a petition for rulemaking to amend the standard. After evaluating the petitions, the agency has decided to modify, as fully explained below, some of the requirements of Standard No. 213. All other requests for modification are denied. The agency is also correcting several minor typographical errors in the text of Standard No. 209.

LABELING

Standard No. 213 requires manufacturers to place a permanently mounted label on the restraint to encourage its proper use. General Motors (GM) petitioned for reconsideration of three of the labeling requirements.

Section S5.5.2 (f) of the standard requires each child restraint to be labeled with the size and weight ranges of children capable of using the restraint. In its petition, GM said that the requirement could "unnecessarily preclude some children from using the restraint or suggest use by children too large for the restraint." GM also commented that some infant restraints are intended to be used from birth and thus the lower size and weight limitation serves no purpose.

In addition, GM said that stating the upper size limit for infant restraints in terms of seated height rather than in standing height is a more appropriate way to set size limitations for infants. For example, GM said that an infant with a short torso and long legs might be precluded from using the restraint if the limitation is stated in terms of standing height, while an infant with short legs and a torso too long for the restraint would be inappropriately included among ones who could supposedly use the restraint. GM requested that infant restraints be allowed to be labeled with an optional statement limiting use by upper weight and seated height.

NHTSA agrees that specifying a lower weight and size limit is unnecessary for an infant carrier designed to be used from birth and has amended the standard accordingly. The agency has decided not to adopt GM's proposal to state the upper size limit in seating rather than standing height. The purpose of the label is to provide important instructions and warnings in as simple and understandable terms as possible. Standing height, rather than seating height, is a measurement parents are familiar with and which is commonly measured during pediatric examinations. As GM pointed out, it is possible to establish a limit based on standing height which would exclude any infant whose seating height is too high to properly use the restraint. Therefore, the agency will continue to require the upper size limit to be stated in terms of standing height.

GM also requested that manufacturers be allowed to establish a lower usage limit for restraints used for older children based on the child's ability to sit upright rather than on his or her size and weight. GM said the lower limit "is not as dependent upon the child's size as it is on the child's ability to hold its head up (sit upright) by itself. This important capability is achieved at a wide range of child sizes." NHTSA agrees that the type of label GM proposes can clearly inform parents on which children can safely use a restraint and therefore will permit use of such a label.

Section S5.5.2(g) of the standard requires the use of the word "Warning" preceding the statement that failure to follow the manufacturer's instructions can lead to injury to a child. GM requested that the word "Caution" be permitted as an alternative to "Warning." GM said that since 1975 it has used caution in its labels and owners' and service manuals as a lead or signal word where the message conveys instructions to prevent possible personal injury. GM said that the words caution and warning are generally accepted as synonymous.

The agency believes that the word "Warning," when used in its ordinary dictionary sense, is a stronger term that conveys a greater sense of danger than the word "Caution" and thus will emphasize the importance of following the specified instructions. Therefore, the agency will continue to require the use of the word "Warning."

Section S5.5.2(k) of the standard requires restraints to be labeled that they are to be used in a rear-facing position when used with an infant. GM said that while the requirement is appropriate for so-called convertible child restraints (restraints that can be used by infants in a rear-facing position and by children in a forward-facing position), it is potentially misleading when used with a restraint designed exclusively for infants. GM said the current label might imply that the restraint can be use in forward-facing positions with children. GM recommended that restraints designed only for infants be permitted to have the statement, "Place this infant restraint in a rear-facing position when using it in the vehicle." The agency's purpose for establishing the labeling requirement was to preclude the apparent widespread misuse of restraints designed for infants in a forward-facing rather than rear-facing position. Since GM's recommended label will accomplish that goal, the agency is amending the standard to permit its use.

RADIUS OF CURVATURE

Section S5.2.2.1(c) of the standard requires surfaces designed to restrain the forward movement of a child's torso to be flat or convex with a radius of curvature of the underlying structure of not less than 3 inches. Ford Motor Co. objected to the three inch limitation on radius of curvature arguing that measuring the radius of curvature of the underlying structure would eliminate designs that have not produced serious injuries in actual crashes. Ford said the shield of its Tot-Guard has a radius of curvature from 2.2 to 2.3 inches and it had no evidence of serious injury being caused by the shield when the restraint has been properly used.

The purpose of the radius of curvature requirement was to prohibit the use of surfaces that might concentrate inpact forces on vulnerable portions of a child's body. It was not the agency's intent tó prohibit existing designs, such as the Tot-Guard, which have not produced injuries in actual crashes. Since a 2 inch radius of curvature should therefore not produce injury, the agency has decided to change the radius of curvature requirement from 3 to 2 inches.

Although the standard sets a minimum radius of curvature for surfaces designed to restrain the forward movement of a child, it does not set a minimum surface area for that surface. Prototypes of new restraints shown to the agency by some manufacturers indicate that they are voluntarily incorporating sufficient surface areas in their designs. The agency encourages all manufacturers to use surface areas at least equivalent to those of the designs used by today's better restraints.

OCCUPANT EXCURSION

Section S5.1.3.1 of the standard sets a limit on the amount of knee excursion experienced by the test dummy during the simulated crash tests. It specifies that "at the time of maximum knee forward excursion the forward rotation of the dummy's torso from the dummy's initial seating configuration shall be at least 15° measured in the sagittal plane along the line connecting the shoulder and hip pivot points."

Ford Motor Co. objected to the requirements that the dummy's torso rotate at least 15 degrees. Ford said that it is impossible to measure the 15 degree angle on restraints such as the Tot-Guard since the test dummy "folds around the shield in such a manner that there is no 'line' from the shoulder to the hip point." In addition, restraints, such as the Tot-Guard, that enclose the lower torso of the child can conceal the test dummy hip pivot point.

The agency established the knee excursion and torso rotation requirements to prevent manufacturers from controlling the amount of test dummy head excursion by allowing the test dummy to submarine excessively during a crash (i.e., allowing the test dummy to slide too far downward underneath the lap belt and forward, legs first). A review of the agency's testing of child restraints shows that current designs that comply with the knee excursion limit do not allow submarining. Since the knee excursion limit apparently will provide sufficient protection to prevent submarining, the agency has decided to drop the torso rotation requirement. If future testing discloses any problems with submarining, the agency will act to establish a new torso rotation requirement as an additional safeguard.

HEAD IMPACT PROTECTION

Section 5.2.3 requires that each child restraint designed for use by children under 20 pounds have energy-absorbing material covering "each system surface which is contactable by the dummy head." Strolee petitioned the agency to amend this requirement because it would prohibit the use of unpadded grommets in the child restraint. Strolee explained that some "manufacturers use grommets to support the fabric portions of a car seat where the shoulder belt and lap belt penetrate the upholstery. These grommets retain the fabric in place and give needed support where the strap comes through to the front of the unit." Because of the use of the grommets in positioning the energy-absorbing padding and belts, the agency does not want to prohibit their use. However, to ensure that use of the grommets will not compromise the head impact protection for the child, the agency will only allow grommets or other structures that comply with the protrusion limitations specified in section S5.2.4. That section prohibits protrusions that are more than ⅜ of an inch high and have a radius of less than ¼ inch. Because this amendment makes a minor change in the standard to relieve a restriction, prior notice and a comment period are deemed unnecessary.

BELT REQUIREMENTS

Strolee petitioned the agency to amend the requirement that all of the belts used in the child restraint system must be 1½ inches in width. Strolee said that straps used in some restraints to position the upper torso restraints have " 'snaps' so that the parent may release this positioning belt conveniently." Strolee argued that such straps should be exempt from the belt width requirement since "the snap would release far before any loads could be experienced."

The agency still believes that any belt that comes into contact with the child should be of a minimum width so as not to concentrate forces on a limited area of the child. This requirement would reduce the possibility of injury in instances where the snap on a positioning strap failed to open. Strolee's petition is therefore denied.

Strollee has also raised a question about the interpretation of section S5.4.3.3 on belt systems. Strolee asked whether the section requires a manufacturer to provide both upper torso belts, a lap belt and a crotch strap or whether a manufacturer can use a "hybrid" system which uses upper torso belts, a shield, in place of a lap belt, and a crotch strap. The agency's intent was to allow the use of hybrid systems. The agency established the minimum radius of curvature requirements of section S5.2.2.1(c) to ensure that any shield used in place of a lap or other belt would not concentrate forces on a limited area of the child's body. NHTSA has amended section S5.4.3.3. to clarify the agency's intent. Because this is an interpretative amendment, which imposes no new restrictions, prior notice and a comment period are deemed unnecessary.

HEIGHT REQUIREMENTS

Strolee asked the agency to reconsider the requirements for seat back surface heights set in section S.5.2.1.1. Strolee argued that the higher seat back required by the standard would restrict the driver's rear vision when the child restraint is placed in the rear seat.

The final rule established a new seat back height requirement for restraints recommended for use by children that weigh more than 40 pounds. To provide sufficient protection for those children's heads, the agency required the seat back height to be 22 inches. The agency explained that the 22 inch requirement was based on anthropometric data showing that the seating height of children weighing 40 or more pounds can exceed 23 inches. The agency still believes that 22 inch requirement is necessary for the protection of the largest child for which the restraint is recommended. NHTSA notes that child restraints can be designed to accommodate the higher seat backs without allowing the overall height of the child restraint to unduly hinder the driver's vision.

PADDING

In its petition, JPMA claimed that the standard "calls for the application of outdated specifications" for determining the performance of child restraint padding in a 25 percent compression-deflection test. A review of the most recent edition of the American Society for Testing and Materials (ASTM) handbook shows that the compression-deflection test in two of the three ASTM standards (ASTM D1565) referenced by the agency has been replaced. However, the replacement standard does not contain a 25 percent compression-deflection test. Therefore, the agency will continue to use the three ASTM standards referenced in the December 1979 final rule.

EFFECTIVE DATE

Cosco, Strolee and the Juvenile Products Manufacturers Association (JPMA) petitioned the agency for an extension of the June 1, 1980, effective date. They requested that the effective date be changed to at least January 1, 1981, and Strolee requested a delay until March 1, 1981. They argued that the June 1, 1980, effective date does not allow manufacturers sufficient time to develop, test and tool new child restraints.

Testing done for the agency has shown that many of the better child restraint systems currently on the market can meet the injury criteria and occupant excursion limitation set by the standard. Some of those seats would need changes in their labeling, removal of arm rests and new belt buckles and padding to meet the standard. Such relatively minor changes can be made in the time available before the June 1, 1980, effective date.

Several manufacturers have informed the agency that they are designing new restraints to meet the standard. Based on prototypes of those restraints shown to the agency, NHTSA believes that these new restraints may be more convenient to use, less susceptible to misuse and provide a higher overall level of protection than current restraints. Based on leadtime information provided by individual manufacturers and the JPMA, the agency concludes that extending the standard from June 1, 1980, to January 1, 1981, will provide sufficient leadtime. Providing a year's leadtime is in agreement with the leadtime estimates provided by the manufacturers as to the time necessary for design and testing, tooling and buckle redesign.

COMPATIBILITY WITH VEHICLE BELTS

On December 12, 1979, NHTSA held a public meeting on child transportation safety. At that meeting, several participants commented about the difficulty, and in some cases the impossibility, of securing some child restraint systems with a vehicle lap belt because the belt will not go around the restraint. Testing done by the agency during the development of the recently proposed comfort and convenience rulemaking also confirms that problem. The agency reminds child restraint manufacturers that Standard No. 213, *Child Restraint Systems,* requires all child restraints to be capable of being restrained by a vehicle lap belt.

Joan Claybrook
Administrator

45 F.R. 29045
May 1, 1980

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems (Docket No. 74-09; Notice 8)

ACTION: Correction.

SUMMARY: On May 1, 1980, the agency published a notice in the *Federal Register* responding to petitions for reconsideration concerning Standard No. 213, Child Restraint Systems. In response to a petition from Ford Motor Co., the agency stated in the preamble of the notice that it was eliminating the torso rotation requirement of the standard. However, the notice inadvertently did not amend the standard to delete that requirement. This notice makes the necessary amendment.

DATES: The amendment is effective upon publication in the *Federal Register,* October 6, 1980.

FOR FURTHER INFORMATION CONTACT:
Stephen Oesch, Office of Chief Counsel, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. (202-426-2992)

SUPPLEMENTARY INFORMATION: On May 1, 1980, the agency published a notice responding to several petitions for reconsideration concerning Standard No. 213, Child Restraint Systems (45 FR 29045).

Among the petitions was one from Ford Motor Co. objecting to the requirement that the test dummy's torso rotate at least 15 degrees during the simulated crash test of the child restraint. Ford argued that it is impossible to measure the 15 degree angle on restraints such as its Tot-Guard which enclose the lower torso of the child and thus conceal one of the pivot points used in measuring the dummy's rotation.

In response to the Ford petition, the agency decided to drop the torso rotation requirement. In the May 1 notice, the agency explained that the purpose of the requirement was to prevent manufacturers from controlling the amount of head excursion by allowing the test dummy to submarine excessively during a crash (i.e., allowing the test dummy to slide too far downward underneath the lap belt and forward, legs first). After further reviewing its child restraint test results, the agency concluded that restraints meeting the knee excursion limit of the standard will provide sufficient protection to prevent such submarining.

Section 5.1.3.1 is revised to read as follows:

S5.1.3.1 Child restraint systems other than rear-facing ones and car beds. In the case of each child restraint system other than a rear-facing child restraint system or a car bed, the test dummy's torso shall be retained within the system and no portion of the test dummy's head shall pass through the vertical transverse plane that is 32 inches forward of point z on the standard seat assembly, measured along the center SORL (as illustrated in Figure 1B), and neither knee pivot point shall pass through the vertical transverse plane that is 36 inches forward of point z on the standard seat assembly, measured along the center SORL.

Issued on September 26, 1980.

Michael M. Finkelstein
Associate Administrator
for Rulemaking

45 FR 67095
October 9, 1980

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems
(Docket No. 74-09; Notice 9)

ACTION: Final rule.

SUMMARY: This notice amends Standard No. 213, Child Restraint Systems, to allow the use of thinner padding materials in some child restraints. The agency proposed the amendment in response to a petition for rulemaking filed by General Motors Corporation.

DATES: The amendment is effective on December 15, 1980.

ADDRESSES: Petitions for reconsideration should refer to the docket number and be submitted to: Docket Section, Room 5108, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590. (Docket hours: 8:00 a.m. to 4:00 p.m.)

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2264)

SUPPLEMENTARY INFORMATION: On December 13, 1979, NHTSA issued Standard No. 213, Child Restraint Systems (44 FR 72131). The standard established new performance requirements for child restraints, including requirements for the padding used in child restraint systems recommended for use by children under 20 pounds (i.e., infant carriers).

The padding requirements provide that surfaces of the infant carrier that can be contacted by the test dummy's head during dynamic testing must be padded with a material that meets certain thickness and static compression-deflection requirements. The standard requires that the padding must have a 25 percent compression-deflection resistance of not less than 0.5 and not more than 10 pounds per square inch (psi). Material with a resistance of between 3 and 10 psi must have a thickness of ½ inch. If the material has a resistance of less than 3 psi, it must have a thickness of at least ¾ inch.

In response to a petition for rulemaking filed by General Motors Corporation (GM), the agency proposed on October 17, 1980 (45 FR 68694) to modify the padding requirements to allow the use of thinner padding. GM's petition said that the compression-deflection resistance of padding is sensitive to the rate at which deflection occurs during the test procedure. As the deflection rate increases during testing, so does the measured resistance of the material. GM said that the padding used in the head impact area of its child seat has a maximum compression-deflection resistance of 3 psi. However, several different deflection rates are permitted by the American Society for Testing and Materials test procedures incorporated into Standard No. 213. GM reported that the measured 25 percent compression-deflection value of the padding it uses can be as low as 1.8 psi.

To accommodate variations attributable to the use of the different deflection rates permitted in the testing, the agency proposed to allow the use of padding with a compression-deflection resistance of 1.8 psi or more to have a minimum thickness of ½ inch.

The notice denied GM's petition to permit the use of padding with a compression-deflection resistance of 0.2 psi and a thickness of ⅜ or ¾ inch.

GM, the only party that commented on the proposal, supported the proposed revision.

GM requested the agency to reconsider its decision to prohibit the use of padding with a compression-deflection resistance of 0.2 psi. GM argued that the field performance of its child

restraints shows that current padding material is effective in reducing deaths and injuries.

As explained in the October notice, the agency agrees that child restraints, such as GM's infant carrier, which have an energy-absorbing shell can provide effective protection with padding having a compression-deflection resistance of 0.2 psi. Many infant carriers, however, use rigid plastic shells rather than energy absorbing shells. Manufacturers of the rigid plastic shells currently use padding with a compression-deflection resistance of 0.5 psi. The agency does not want to degrade that level of performance and therefore GM's request is again denied.

COSTS

The agency has assessed the economic and other impacts of the proposed change to the padding requirements and determined that they are not significant within the meaning of Executive Order 12221 and the Department of Transportation's policies and procedures for implementing that order. Based on that assessment, the agency concludes further that the economic and other consequences of this proposal are so minimal that additional regulatory evaluation is not warranted. When Standard No. 213 was published in the *Federal Register* on December 12, 1979, the agency placed in the docket for that rulemaking a regulatory evaluation assessing the effect of the padding requirements set by the standard. The effect of that rule adopted today is to permit the use of some padding materials in a thickness of ½ inch rather than ¾ inches. Such a change will slightly reduce manufacturer padding costs.

The agency finds, for good cause shown, that an immediate effective date for this amendment is in the public interest since it relieves a restriction in the standard that goes into effect on January 1, 1981.

The principal authors of this notice are Vladislav Radovich, Office of Vehicle Safety Standards, and Stephen Oesch, Office of Chief Counsel.

For the reasons set out in the preamble, Part 571 of Chapter V of Title 49, Code of Federal Regulations, is amended as set forth below.

§571.213 [Amended]

1. 49 CFR Part 571 is amended by revising paragraph §S5.2.3.2(b) of §571.213 to read as follows:

* * * * *

(b) A thickness of not less than ½ inch for materials having a 25 percent compression-deflection resistance of not less than 1.8 and not more than 10 pounds per square inch when tested in accordance with S6.3. Materials having 25 percent compression-deflection resistance of less than 1.8 pounds per square inch shall have a thickness of not less than ¾ inch.

Issued on December 8, 1980.

Joan Claybrook
Administrator

45 FR 82264
December 15, 1980

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems
(Docket No. 74-09; Notice 11)

ACTION: Technical amendment.

SUMMARY: When the final rule establishing Standard No. 213, *Child Restraint Systems*, was issued, it included a section setting requirements for a diagram to show the proper installation of a child restraint within a vehicle. Although the preamble discussed the installation diagram requirement, the standard inadvertently did not require the diagram to be placed on the restraint. This notice makes the necessary technical amendment to correct the standard.

EFFECTIVE DATE: August 26, 1982.

SUPPLEMENTARY INFORMATION: In May 1978, the agency proposed a substantially upgraded Standard No. 213, *Child Restraint Systems* (43 F.R. 21470). In section 5.5.2(a)-(k) of the standard, the agency proposed requirements for certain warning and installation labaels for child restraints. In particular, section 5.5.2(k) proposed specific requirements for a diagram showing the proper installation of a child restraint in a vehicle. Section 5.5.1 of the standard proposed that all of the labels specified in 5.5.2(a)-(k) would have to be placed permanently on the child restraint.

When the agency issued its final rule, it expanded the labeling requirements for child restraints (44 F.R. 72131). The preamble for the final rule discussed the specifics of the expansion and the reasons for adopting the labeling requirements. Because of the expansion, the installation diagram requirement of section 5.5.2(k) of the proposal was redesignated as section 5.5.2(l) in the final rule. Inadvertently, section 5.5.1 of the standard was not modified to reflect the expansion of the labeling requirements and thus it continued to specify that only the information found in section 5.5.2(a)-(k) be placed on the child restraint.

Most manufacturers recognized the intent of the agency and have placed the correct installation diagram on their restraints. A number of manufacturers apparently have not included such diagrams on their child restraints.

This notice makes the necessary technical amendment to correct the standard to require the installation diagram to be placed on a child restraint. The effective date of this correction is 45 days after the publication of this notice in the *Federal Register*. This will allow time for the few manufacturers that have not included installation diagrams to prepare the needed diagrams for their child restraints.

The agency has determined that there is good cause for not providing additional notice and opportunity to comment on this technical amendment. The public has previously had notice and opportunity to comment on the installation diagram requirement. This technical amendment merely corrects an error arising from the redesignation of the installation diagram requirement during the rulemaking process.

Issued on July 2, 1982.

Courtney M. Price
Associate Administrator
for Rulemaking

47 F.R. 30077
July 12, 1982

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems for Use in Motor Vehicles and Aircraft
[Docket No. 74-09; Notice 14]

ACTION: Final rule.

SUMMARY: This final rule amends Federal Motor Vehicle Safety Standard No. 213, *Child Restraint Systems,* so that child restraint systems can be certified for use in motor vehicles, or for use in both motor vehicles and aircraft. The requirements for certifying child restraints for use in aircraft were formerly specified in the Federal Aviation Administration's (FAA) Technical Standard Order (TSO) C100, which required that in order for child restraint systems to be certified for use in aircraft, they must first be certified for use in motor vehicles and then pass three additional performance tests. Simultaneously with the effective date of this rule, FAA will rescind the requirements of TSO C100 and take action to permit child restraints certified under the requirements of this rule to be used in aircraft.

The notice of proposed rulemaking which preceded this final rule proposed to add the three performance requirements of the TSO and one additional performance requirement for restraints with tether straps to Standard No. 213. This rule adopts one of the three performance requirements of the TSO, the inversion test, and requires that child restraint manufacturers wishing to certify their products for use in both motor vehicles and aircraft certify that the product complies with the requirements of that test. The other performance requirements proposed in the notice are not incorporated in this rule because a joint testing program conducted by FAA and NHTSA last year showed these requirements to be redundant. Child restraints which passed the existing higher performance requirements in Standard No. 213 easily passed the requirements of the TSO, which indicates that those TSO requirements are unnecessary to establish that child restraints are effective in the differing environment of the aircraft interior. Accordingly, compliance with those requirements is no longer required to certify child restraints for use in aircraft.

Child restraints which are certified for use in both motor vehicles and aircraft will be required to be labeled in red with the phrase "THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES AND AIRCRAFT". Child restraints certified only for use in motor vehicles will not be required to change the information currently required by Standard 213 on their labels.

By combining and simplifying the requirements for certifying child restraints for use in motor vehicles and aircraft, FAA and NHTSA hope to encourage more child restraint manufacturers to certify their products for use in both modes of transportation. The ultimate goal of seeking more models of child restraints to be certified for use in both motor vehicles and aircraft is to encourage families traveling by air to use child restraints for their children before, during, and after the air travel portion of their trips.

EFFECTIVE DATE: This rule becomes effective March 30, 1985.

SUPPLEMENTARY INFORMATION: This rule amends Standard No. 213, Child Restraint Systems (49 CFR §571.213), so that child restraint systems can be certified for use in both motor vehicles and aircraft, or simply for use in motor vehicles. These amendments are intended to encourage families traveling by air to use child

restraints to protect their children before, during, and after the air travel portion of their trips.

Background

Need for Increased Use of Child Restraints. Parents cannot adequately protect their very young children against the risk of death and injury while riding in motor vehicles or aircraft either by holding them in their lap or by fastening a lap belt around them. The forces generated during sudden stops even at speeds as low as 10-15 miles per hour (mph) make it physically impossible for a parent to hold and protect a child in his or her arms. Using a lap belt is better, but it is still inadequate for this purpose (particularly for children under the age of 1 year) because of the physical dimensions, bone structure, and weight distribution of young children.

The most effective protection that can be afforded these young children are special supplementary seating devices, which are attached to and secured by the lap belt in the vehicle or aircraft. These devices, generically referred to as child restraints, are specifically designed to take into account the physiological differences between young children and older children and adults, and to offer the appropriate protection for these young children exposed to the large energy levels inherent in vehicle crashes.

Efforts to Promote Increased Use of Child Restraints. The NHTSA has been working hard to promote the use of child restraints by more parents. The agency has been advising the various States on the drafting of mandatory child restraint use laws. Such laws have now been enacted in 49 States and the District of Columbia. These laws have significantly increased the sales and use of child restraints, and increased the public awareness of the safety consequences of allowing children to travel unrestrained in motor vehicles.

In addition, the NHTSA has been working to educate the public on the benefits of child restraints. Working with medical professionals, childbrith educational programs and others, the agency has provided information to pediatricians and prospective parents on ways to protect their children in motor vehicles. Further, the agency has developed manuals on how to develop a child restraint loaner program that can assist parents unable to afford their own child restraints.

All of these factors have succeeded in greatly increasing the use of child restraints for children riding in motor vehicles. Currently, restraint uage for infants less than 1 year old is about 68 percent; and for children ages 1 to 4 the rate is 44 percent; based on the agency's continuing survey of restraint usage in 19 cities.

Impediments to Increased Use of Child Restraints. This heightened use and awareness, combined with the limited number of child restraint models which can be used in both motor vehicles and aircraft, caused confusion and frustration for families traveling by air and car. Both NHTSA and FAA have standards for child restraints. Until recently, of the 42 models of child restraints certified under NHTSA's Standard No. 213 for use in motor vehicles, only five models were also approved under the FAA's standard for use in aircraft. If a family tried to take one of the remaining 37 models of child restraints, they were usually required to check the restraint along with the rest of their luggage. This discouraged families from traveling with the unapproved child restraints, and resulted in the child not having the benefit of the safety seat not only during the takeoff and landing of the aircraft, but also when the family was driving in a motor vehicle on the ground portions of the trip.

From a safety viewpoint, data on injuries and fatalities show that travel by air is much safer than by motor vehicle. For children up to 4 years of age, approximately one fatality and 10 injuries occur yearly during commercial air travel vs. over 600 fatalities and 70,000 injuries to motor vehicle occupants. Consequently, the main benefits from the use of child restraints will be derived from the motor vehicle portion of the trip.

The NHTSA Child Restraint Standard

As an initial step toward ensuring that child restraint systems would offer adequate portection to their occupants, NHTSA issued Standard No. 213 in 1970. That standard, which was issued under the authority granted in the National Traffic and Motor Vehicle Safety Act of 1966, as amended (hereinafter "the Safety Act"; 15 U.S.C. 1381 *et seq.*), became effective in 1971. As then drafted, it specified various static tests to ensure the safe performance of child restraints. However, subsequent data showed that child restraints which passed these static tests might not prove effective at protecting a child in certain vehicle crash situations.

Under the current standard, which became effective January 1, 1981, the performance of child restraint systems is evaluated in dynamic tests under conditions simulating a frontal crash of an average car at 30 mph. The restraint is anchored by a lap belt and, if provided with the restraint, by a supplemental anchorage belt (known as a tether strap). An additional frontal impact test at 20 mph is conducted for restraints equipped with either tether straps or internal harnes and a restraint surface. In that additional test, child restraints with tether straps are tested with the straps detached and child restraints with a restraint surface (e.g., a padded shield) are tested with the restraint surface in place but with the child restraint system's internal harness unbuckled. The additional 20 mph tests are intended to ensure a minimum level of safety performance when the restraints are improperly used. Thus, child restraints with tethers or with a restraint surface are tested at both 20 and 30 mph, while those without tethers or such a surface are tested at 30 mph only. Both the 20 mph and the 30 mph tests are conducted with the child restraint fastened to a seat representing the typical motor vehicle bench seat.

To protect the child, limits are set on the amount of force exerted on the head and chest of a child test dummy during the dynamic testing of restraints specified for children over 20 pounds. Limits are also set on the amount of frontal head and knee excursions experienced by the test dummy in forward-facing child restraints. To prevent a small child from being ejected from a rearward-facing restraint, limits are set on the amount that the seat can tip forward and on the amount of excursion experienced by the test dummy during the simulated crash.

Compliance of child restraints with Standard No. 213 is assured by the requirement in the Safety Act that manufacturers certify compliance for each child restraint. The agency may review the basis for that certification and conduct testing to assure compliance. The Safety Act provides for the assessment of civil penalties for failures to comply with applicable safety standards, and for certifications which the manufacturer in the exercise of due care has reason to know are false or misleading in a material respect.

The FAA Child Restraint Standard

In May 1982, the FAA issued its own child restraint standard, Technical Standard Order (TSO) C100. One of the key factors underlying the development of TSO C100 was child restraint testing conducted by the Civil Aeromedical Institute in 1974. The results of that testing appeared in FAA test report "Child Restraint Systems for Civil Aircraft" (FAA-AM-78-12, March 1978). Another factor was the FAA's determination that differences in the environments of aircraft and motor vehicles necessitated its establishing performance requirements to address the special safety risks posed to young children traveling in aircraft. One of these differences is the tendency of the seat back of aircraft seats to fold forward with the application of a very low force. The FAA determined that there was a need to control the interaction between the young child, especially those facing rearward in a child restraint, and the seat back to ensure that the seat back does not apply unacceptable levels of force onto the child. The FAA also determined that there was a need to address the danger that in-flight turbulence (especially in the upward direction) might throw a child out of his or her child restraint.

Accordingly, the FAA drafted TSO C100 so that it requires each child restraint to meet the requirements of NHTSA's Standard No. 213 and four additional requirements. First, while attached to an aircraft passenger seat with a free-folding seat back by an aircraft safety belt, and occupied by a test dummy, each child restraint must provide protection in an impact producing a 20 mph velocity change. There is no double testing of child restraints with tethers as under Standard No. 213. Such restraints are tested only once in an impact and with their tethers unattached. Second, each child restraint must retain its occupant during an inversion test. Third, each child restraint must withstand the static forces specified in Federal Aviation Regulations §25.561 (14 CFR §25.561), with each of the forces acting separately. Fourth, TSO C100 specifies requirements for marking child restraints with assembly and usage instructions, providing a copy of such instruction to child restraint users and submitting a copy of these instructions and various technical information and test results to the FAA. In addition, the TSO procedures require the establishment and maintenance of a manufacturer quality control system. The quality control system is intended to assure that seats are manufactured in such a way as to meet the standard's performance requirements.

For a child restraint to be approved for use in aircraft, the manufacturer must submit specified information to the FAA along with a certifying statement that the restraint meets the requirements of TSO C100. After the FAA approval is issued, if airlines permit, the restraint can be used for infants or young children during all phases of flight, including takeoff and landing. Once the FAA approved a particular model of child restraint, that agency followed a policy of accepting child restraints of that model that were manufactured prior to the date of approval for use in aircraft during all phases of flight, provided that those earlier child restraints were substantially identical to the approved one and were properly identified as to make and model by a Standard No. 213 certification label.

The result of these differing requirements was that only a few of the child restraints certified for use in motor vehicles were also certified for use in aircraft. In 1983, the National Transportation Safety Board (NTSB) considered the safety problems facing young children traveling in motor vehicles and aircraft and urged that a variety of actions be taken to promote the use of child restraints. It urged that all States adopt laws requiring that infants and young children be placed in child restraints when riding in motor vehicles. It also recommended that the DOT simplify its standards specifying performance requirements for child restraints by combining all technical requirements into a single standard (NTSB Safety Recommendations A-83-1, issued February 24, 1983).

After considering the benefits which would result from the increased use of child restraints, the FAA and the NHTSA jointly concluded that the process of certifying child restraints for use in both motor vehicles and aircraft could and should be simplified and expedited. By combining the separate NHTSA and FAA standards into a single standard under the jurisdiction of a single agency, child restraint manufacturers could avoid the difficulties of dealing with different standards, methods of certification, and testing procedures promulgated by the two agencies. Accordingly, a notice of proposed rulemaking (NPRM) was published at 48 FR 36849, August, 1983.

Details of the NPRM

The NPRM proposed that the NHTSA would be the sole agency responsible for enforcing the new Standard No. 213, which would be applicable to child restraint systems designed for use in both motor vehicles and aircraft. In essence, the NPRM proposed that the requirements in both agencies standards for child restraints be unchanged and simply combined into an expanded Standard No. 213, with one further performance test added for child restraints to be certified for use in aircraft. This would avoid the problems inherent in dealing with the differing certification procedures of the two agencies and consolidate all of the requirements into one standard.

Under the proposal, manufacturers which elected to certify their child restraints for use on aircraft would have to certify that these restraints could pass those four additional tests. Those manufacturers which did not elect to certify their restraints for use on aircraft would not have to make that certification. The existing requirements in Standard No. 213 applicable to child restraints certified for use in motor vehicles were not proposed to be changed in any way by the NPRM. What was proposed was simply an option for manufacturers to subject their restraints to some additional testing if they wanted to certify those restraints for use on aircraft.

Three of the four additional performance tests proposed to be added to Standard No. 213 for child restraints certified for use on aircraft were drawn almost verbatim from the FAA's child restraint standard. These additional tests were proposed to be required to ensure that child restraints certified for use in aircraft would offer adequate protection to young children in the unique interior environment of aircraft.

The first additional test proposed in the NPRM was a dynamic impact test at 20 mph for all restraints not equipped with a tether strap. The child restraint would be attached to a representative aircraft seat only by the aircraft seat belt attached to the aircraft seat. The child restraint would not be permitted to fail or deform in a manner that could seriously injure or prevent subsequent extrication of the occupant. This test was taken almost verbatim from paragraph (a)(2)(i) of TSO C100.

The second additional test proposed in the NPRM would apply only to child restraints equipped with a tether strap. These restraints would be tested under the same procedures as untethered restraints, except that the impact would be at 30 mph with the tether strap unattached. The

same criteria for determining satisfactory performance specified above for untethered restraints would again be used. This requirement was not drawn from TSO C100. However, NHTSA decided to include the requirement because the FAA believed that, since aircraft seats have no place to which the tether strap could be anchored, it was necessary to subject such restraints to a more stringent performance test to ensure that these restraints would offer adequate aircraft safety.

The third test proposed in the NPRM was an inversion test. Its purpose is to ensure that the child restraint could protect the child from air turbulence. The test, drawn directly from the language of paragraph (a)(2)(ii) of TSO C100, would have required the combination of a child restraint, test dummy, and aircraft passenger seat to be rotated to an inverted position and held there without any failure or deformation of the child restraint that would seriously injure or prevent the subsequent removal of the occupant.

The fourth additional test proposed in the NPRM would have required each child restraint to withstand the ultimate inertia forces specified in 14 CFR §25.561, with each of those forces acting separately. This requirement was specified in paragraph (a)(2)(iii) of TSO C100. Engineering analysis would have been acceptable in lieu of actual testing to establish compliance with this proposed requirement.

The procedures to be followed in conducting these tests or analyses were drawn from paragraph (a)(2)(iv) of TSO C100. They provided for the testing or analysis of child restraints to determine their adequacy for protecting the weight and stature of child for which the restraint is designed. The test dummies to be used were those specified in section S7 of Standard No. 213. Other procedural provisions related to the placing of the test dummy in the restraint, the attaching of the restraint to the aircraft seat, and the design of the aircraft seat.

As noted above, the NPRM gave child restraint manufacturers an option either to certify their restraints for use in both motor vehicles and aircraft or to certify the restraints only for use in motor vehicles. Those electing the latter option would have been required by the NPRM to include the statement, "THIS RESTRAINT IS NOT CERTIFIED FOR USE IN AIRCRAFT", on the certification label and operating instructions for the child restraint. This labeling requirement was proposed to ensure that parents seeking to buy restraints for use in both modes of transportation and airline flight attendants would easily ascertain whether a particular child restraint was not certified for use in aircraft.

The NPRM also announced that FAA and NHTSA would jointly test many models of child restraints for compliance with the TSO C100 requirements. The test results generated by this program were made available to the manufacturers of the tested restraints to assist them to certify their child restraints for use in both modes of transportation.

FAA-NHTSA Testing of Child Restraints

The testing program evaluated all 42 models of child restraints currently manufactured and certified as meeting the requirements of Standard No. 213 to determine whether they complied also with the existing requirements of TSO C100. (See DOT HS-806-413) There was some preliminary difficulty in determining how to establish whether a child restraint system had "failed or deformed in a manner that could seriously injure or prevent subsequent extrication of a child occupant," the criterion for determining compliance with the tests in TSO C100. The two agencies agreed to use the performance requirements specified in section S5 of Standard No. 213, but to exclude the head and chest acceleration requirements set forth in section S5.1.2.

All 42 models of child restraints, including the 11 which have tether straps, were subjected to the 20 mph dynamic test while attached to a representative aircraft seat, and all passed by a considerable margin. Similarly, the three tethered child seats and eight tethered booster seats were subjected to a 30 mph impact with the tether unattached, and all again passed by a considerable margin. The performance of the three tethered child seats was not appreciably different than was registered by them in the 20 mph impact test, and the head and knee excursions measured in this test were well under those recorded for the restraints in the Standard No. 213 tests. All 42 models were subjected to the TSO C100 inversion test, and all 42 were deemed to have passed those requirements. Additionally, all 42 models were subjected to the static loading tests at the levels specified in TSO C100, and all 42 passed the test.

All 42 models were also tested to the requirements of "old" Standard No. 213, which required

the restraint to withstand inertia loads approximately 3 times greater than those specified in TSO C100. Standard No. 213 was upgraded from these old requirements primarily because of the structural failures which occurred in 30 mph dynamic tests of restraints which met the static load requirements under the old version of the standard. NHTSA believed that any of the restraints which could satisfy the dynamic testing requirements of the new Standard No. 213 would also satisfy the static loading requirements of the old standard. Since the loads required under the old standard were approximately 3 times the level required by the TSO, any devices which could satisfy the old standard would *ipso facto* satisfy the TSO requirements.

In this testing to the levels prescribed under the old standard, 40 of 42 models of child restraints passed. The two restraints which failed the tests did so in only one direction, and at load levels 2½ times those required in the TSO.

The joint testing program made it possible for the manufacturers of every model of child restraint currently produced to seek prompt FAA approval for the restraints under TSO C100. This has expedited the process for certifying current models of child restraints for both aircraft and motor vehicle use. At present 36 models have received TSO approval.

However, the Department of Transportation still believes that it is necessary to proceed with a final rule in this area. As a practical matter, new child restraints will be introduced into the market, and those models would face the same obstacles which were confronted by current models before the completion of the joint testing program. It is poor regulatory policy to subject manufacturers to needless and repetitious testing of the identical product to satisfy slightly differing requirements of two different agencies. These considerations impel FAA and NHTSA to proceed to a final rule at this time, so that the situation which existed prior to the joint testing program does not recur at some future date.

Comments

Most of the more than 20 commenters on the NPRM endorsed the concept of combining the FAA and NHTSA standards into one standard. Some of the commenters expressed qualified support for the concept, but reserved final judgment until the results of the joint testing program were made available to the public.

Only one commenter opposed the basic concept of combining the two standards, and that opposition was based on the belief that NHTSA was neither competent nor properly equipped to regulate items related to avaiation and the aircraft industry. First, NHTSA believes it should be emphasized that this rule was developed with the cooperation and support of the FAA, which certainly has the necessary expertise regarding the aviation industry. Further, child restraints are not items which are uniquely related to aviation and the aircraft industry; most of the lifesaving benefits of child restraints accrue while the young child is riding in a motor vehicle. Finally, both NHTSA and FAA gained new knowledge about the interplay of the aircraft seat, child restraint, and child during a sudden deceleration during the recently completed joint testing program. For these reasons, the agencies believe it is appropriate to go forward with this rulemaking.

Several comments raised issues outside the scope of this rulemaking. These included permissible seat positions for approved child restraints in aircraft, retroactive certification for aircraft use of models recently approved for such use, the extent to which individual airlines must examine the restraint's certification to determine its validity, differences in the various airlines' policies permitting the use of child restraints, and so forth. This rulemaking is addressing only the steps child restraint manufacturers must take to certify their products for use in motor vehicles and aircraft. The procedures regulating the actual use of the restraints in aircraft are not being addressed herein; such procedures will be decided solely by the FAA. These and other questions on the procedures should be addressed to that agency.

The commenters made several objections to each of the four proposed additional requirements, to which compliance would have to be certified if a manufacturer wanted to certify its child restraint for use in aircraft. Regarding the first proposed additional test that child restraints without tether straps be tested in an aircraft seat at a 20 mph impact, these commenters argued that all child restraints certified as complying with Standard No. 213 are already subjected to a 30 mph impact in the more severe environment of a car seat. Accordingly, this argument continued, the proposal to require a lower speed test in a less severe environment would simply add to the testing burden for child restraint manufacturers, without ensuring any higher degree of safety.

One of the child restraint manufacturers correctly noted in its comments that the reason for proposing the 20 mph test in the aircraft seat was the concern that the more flexible back of such a seat could snap forward on impact and hit the child restraint and/or child with additional crash forces and that those additional forces would not be considered in the 30 mph test with the restraint attached to a car seat. This commenter suggested that their own testing and some NHTSA tests in 1982 showed that the back of the aircraft seat does not exert significant forces relative to the crash forces. The commenter concluded that NHTSA should delete this proposed requirement unless the joint testing program showed some evidence that significant forces were actually exerted.

The joint testing program showed that the forces to which the test dummy and restraint are subjected in the 20 mph dynamic test in the aircraft seat were 1/3 to 1/2 less than those to which they were subjected in the 30 mph dynamic test in the car seat. This finding was hardly significant or surprising, given the lower speed at impact.

A far more significant finding was made regarding the amount of the loading imposed by the flexible aircraft seat back on the restrained dummy. For this testing, the aircraft seat back was instrumented with a triaxial accelerometer so that quantitative assessments of the produced forces could be made. Inspection of the acceleration-time histories and the loads measured on the aircraft seat belts revealed that in every test the maximum forces generated by the child restraints (as measured by the test dummy and including the peak head and chest accelerations and the peak belt loads) occurred some 25-40 milliseconds before the occurrence of the peak acceleration of the seat back. Also, the magnitude of the head and chest accelerations imparted to the child seat occupant by the restraining action of child seats were much higher than those imparted later on by the action of the aircraft seat back. These facts indicate that the loads imparted when the seat back struck the child restraint and its occupant are relatively insignificant when compared with the loads imparted by the crash. Confirmation of this was found in the fact that the seat back acceleration had no significant influence on the head and chest accelerations measured in the test dummies. However, the loads measured on the aircraft seat belt were increased during the seat back acceleration. This finding suggests that the load exerted by the acceleration of the seat back is transferred directly through the structure of the child restraint to the seat belt. This fact would again confirm the view that the seat back acceleration poses no threat to the occupant of a child restraint.

Based on these results, which occurred in each test, NHTSA believes that it has been established that seat back acceleration poses an inconsequential threat to occupants of child restraints, and that any restraint which protects its occupant against the crash forces will adequately protect its occupant against the forces generated by the seat back acceleration. Given these conclusions, it is unnecessary to test child restraints for their ability to protect a child against the threat of the folding aircraft seat back. Accordingly, the agency has deleted the requirement that child restraints be certified for use in aircraft capable of protecting a restrained child in a 20 mph impact when attached to an aircraft seat.

Many of the commenters objected to the requirement that tethered restraints be subjected to a 30 mph crash in an aircraft seat with the tether unattached. The rationale for these objections was perhaps best summed up in the NTSB comment. The NTSB stated that it could understand subjecting restraints with tethers to the same test as restraints without tethers, and not permitting the restraints with tethers to have their tether strap attached during the test. Such a proposal would ensure that these restraints could pass the same requirements as other child restraints, and that they could do so under the conditions present in aircraft; i.e., with their tether straps unattached. However, the NTSB continued, it was not justifiable to require these restraints to undergo a more severe test than other restraints. One child restraint manufacturer commented that this 30 mph test requirement would not ensure any higher level of safety on aircraft since the aircraft seats themselves would not withstand a 30 mph impact. This commenter went on to say that in an actual crash at 30 mph, there is as much potential of injury to the child from the failure of the aircraft seat itself as from the failure of the child restraint.

As indicated above in the section summarizing the joint testing program, the tests conducted on child restraints with tethers showed that all of those restraints easily passed this 30 mph crash test requirement, that the results were not much higher than were those measured in the 20 mph tests, and that the results showed an appreciably

lower force level for the restraints in this test than were obtained in the Standard No. 213 misuse test. Given the conclusion that the seat back acceleration does not transmit any significant forces to the occupant of the child restraint and the fact that this test imposes lower crash forces than the Standard No. 213 tests, it seems unnecessary to require the child restraint manufacturers to certify compliance with this test. The points made in the comments on this proposal also are convincing, so it has been determined not to incorporate this test in the final rule.

The third proposed additional test was an inversion test whose purpose is to ensure that the child restraints certified for use in aircraft could adequately protect the child against the dangers posed by sudden air turbulence. The commenters who addressed this issue seemed to generally agree that this was a hazard which child restraints for use in aircraft should protect against and that restraints which passed the requirements of Standard No. 213 would not necessarily pass this test. NHTSA also believes that the inversion test was not shown to be redundant of existing test procedures, and has determined that this test should be incorporated in this final rule. The requirements for this inversion test are adopted verbatim from those proposed in the NPRM. Several commenters questioned some of the inversion test procedures and offered suggested alternatives. The agency agrees that some refinements could be made. However, it is necessary first to issue a new NPRM. The NPRM, which proposes to amend the requirements for the inversion test adopted in this rule, discusses these comments further.

The fourth additional test proposed in the NPRM was a static load test. Several commenters questioned the need for the relatively low inertial loads of that test to be applied to the restraints, considering the much greater loads to which the child restraint is subjected in the testing for Standard No. 213. This fact, together with the joint testing results which showed that all currently produced child restraints can withstand loads at least 2½ times greater than those specified in this proposed test, leads NHTSA to conclude that this test is redundant and does not ensure any higher level of safety. Accordingly, it is not adopted in this final rule.

Several commenters addressed the criteria used to determine if a child retraint has passed the two simulated crash tests and the inversion test applicable to restraints for aircraft use. These criteria were that the child restraint system "may not fail nor deform in a manner that could seriously injure or prevent subsequent extrication of a child occupant." Some of the child retraint manufacturers asked precisely how one determines if a restraint has failed or deformed in such a manner. Another commenter opined that those criteria "are so vague and subjective as to be of no substantive value whatsoever."

NHTSA agrees with these commenters' judgment that the criteria for determining compliance could be made more objective. However, the Administrative Procedure Act requires that interested persons be given notice of proposed rulemaking and an opportunity to comment thereon prior to an agency's adopting changed requirements as a final rule (5 U.S.C. 553). This provision of the law prevents the agency from adopting these more objective criteria in this final rule, because the interested persons would not have had an opportunity to comment on those criteria. Accordingly, NHTSA is today publishing a notice of proposed rulemaking to incorporate more objective criteria for the inversion test. This notice has a 45-day comment period, to provide any interested persons with the chance to comment on the changes while allowing the agency to move promptly to incorporate more objective criteria.

Most of the commenters addressed the issues raised by the language proposed to be labeled on child restraints which were certified only for use in motor vehicles. The NPRM proposed that such child restraints have the statement "THIS RESTRAINT IS NOT CERTIFIED FOR USE IN AN AIRCRAFT." A number of commenters opposed this "negative" labeling because it could give consumers the impression that such a restraint was not as safe for motor vehicle use as a restraint which was certified for use in both aircraft and motor vehicles. In fact, both restraints would have been certified as passing the same dynamic tests for use in motor vehicles. Other problems alleged to exist with this labeling scheme were that consumers would not be sure whether a child restraint not bearing such a label could be used safely in aircraft, and that this "negative" labeling could result in older, unlabeled and uncertified seats being used on aircraft. Further, the proposed labeling could make it difficult for flight attendants to determine which restraints were actually approved for use in aircraft, causing delays and

frustration for parents wishing to use child restraints on flights. These commenters all requested that the "negative" labeling proposed in the NPRM be replaced with a simple positive statement in the final rule.

NHTSA agrees with these comments. The informational purposes of the labeling requirement would be better served by simple positive declarations. The labeling requirement adopted in the final rule specifies that child restraints certified for use only in motor vehicles recite the same certification that is currently required, with no additional statements, and those restraints certified for use in both motor vehicles and aircraft simply add a statement of that dual certification.

Finally, a child restraint manufacturer asked that the final rule clarify the standard aircraft seat assembly to be used for testing the child restraint. The NPRM stated in section S7.3(b) that a "representative aircraft passenger seat" be used. The term "representative aircraft passenger seat" was defined S5 of the NPRM as either a production seat approved by the FAA or a simulated seat conforming to Drawing Package SAS-100-2000. NHTSA believes this definition is clear, and will result in consistent test results. No further changes to this definition have been made in this final rule.

OMB Clearance

The labeling requirements for child restraints are considered to be information collection requirements, as that term is defined by the Office of Management and Budget (OMB) in 5 CFR Part 1320. OMB has approved the labeling requirements for child restraints certified for use in motor vehicles (CMB No. 2127-0511), but has not approved the labeling requirements for child restraints certified for use in motor vehicles and aircraft. Accordingly, those labeling requirements have been submitted to the OMB for its approval, pursuant to the requirements of the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 *et seq.*). A notice will be published in the *Federal Register* when OMB approves this information collection.

Impacts

NHTSA has analyzed the impacts of this rule and determined that the rule is not "major" within the meaning of Executive Order 12291, but is "significant" within the meaning of the Department of Transportation regulatory policies and procedures. The rule simplifies and combines the requirements of two existing government regulatios into one regulation. It would not impose any new burdens upon any manufacturer. If a child restraint manufacturer wishes to continue certifying one of its child restraint models for use in motor vehicles only, the requirements for doing so are unchanged and the testing costs would remain at about $3,500. If a child restraint manufacturer wishes to certify a model for use in motor vehicles and aircraft, its testing costs under Standard No. 213 would increase by about $1,500 to a total of about $5,000. However, the total testing costs for certifying a model to this combined Standard No. 213 will be less than the total testing costs for certifying compliance with Standard No. 213 and TSO C100 (estimated at about $8,000). Further, this cost reduction and the need to certify to only one agency's regulation, instead of two agencies' regulations, should provide a slightly reduced cost of compliance for those child restraint manufacturers that choose to certify their products for use in motor vehicles and aircraft. Although these impacts are minimal, a regulatory evaluation has been prepared.

In consideration of the foregoing, the following amendments are made to section 571.213, *Child Restraint Systems*, of Title 49 of the Code of *Federal Regulations*.

1. Section S1 is amended to read as follows:

S1. *Scope.* This standard specifies requirements for child restraint systems used in motor vehicles and aircraft.

2. Section S2 is amended to read as follows:

S2. *Purpose.* The purpose of this standard is to reduce the number of children killed or injured in motor vehicle crashes and in aircraft.

3. Section S3 is amended to read as follows:

S3. *Application.* This standard applies to child restraint systems for use in motor vehicles and aircraft.

4. The definition of "Child restraint system" in section S4 is amended to read as follows:

"Child restraint system" means any device except Type I or Type II seat belts, designed for use in a motor vehicle or aircraft to restrain, seat, or position children who weigh 50 pounds or less.

5. Section S4 is amended by adding the following new definitions in alphabetical order:

"Representative aircraft passenger seat" means either a Federal Aviation Administration approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Drawing Package SAS-100-2000.

6. Section S5 is amended to read as follows:

S5. *Requirements for child restraint systems certified for use in motor vehicles.* Each child restraint certified for use in motor vehicles shall meet the requirements in this section when, as specified, tested in accordance with S6.1.

7. Section S5.5.2 is revised by the addition of a new paragraph (m) which reads as follows:

(m) Child restraints that are certified as complying with the provisions of section S8 shall be labeled with the statement "THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES AND AIRCRAFT". This statement shall be in red lettering, and shall be placed after the certification statement required by paragraph (e) of this section.

8. Section S7.3 is revised to read as follows:

S7.3 *Standard seat assemblies.* The standard seat assemblies used in testing under this standard are:

(a) For testing for motor vehicle use, a simulated vehicle use, a simulated vehicle bench seat, with three seating positions, which is described in Drawing Package SAS-100-1000 (consisting of drawings and a bill of materials); and seat.

9. A new section S8 is added to the standard to read as follows:

S8. *Requirements, test conditions, and procedures for child restraint systems manufactured for use in an aircraft.* Each child restraint system manufactured for use in both motor vehicles and aircraft must comply with all of the applicable test requirements specified in section S5 and, when tested in accordance with the conditions and procedures of S8.2, the additional requirements specified in section S8.1.

S8.1 Child containment for conditions of inflight turbulence must be determined by inversion tests. The combination of a representative aircraft passenger seat, child restraint system, and appropriate test dummy must be rotated from the normal unright position to an inverted position. The combination must remain inverted for at least 3 seconds with neither failure nor deformation that could seriously injure or prevent subsequent extrication of a child occupant. Child containment must be demonstrated for rotation in the forward direction and a sideward direction.

S8.2 Each configuration and mode of installation must be tested for protection of a child of a weight and stature for which the child restraint system is designed. The child occupant must be simulated with an appropriate test dummy as specified in paragraph S7. Placement of each restraint system in a representative aircraft passenger seat and placement of the test dummy must be in accordance with the manufacturer's instructions. Each child restraint system must be attached to the seat by means of an aircraft safety belt without supplementary anchorage belts or tether straps; FAA Technical Standard Order approved safety belt extensions may be used. The representative aircraft passenger seat used in each test must have a seat back that is completely free to fold over.

Issued on August 24, 1984

Diane K. Steed
Administrator

49 FR 34357
August 30, 1984

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems for Use in Motor Vehicles and Aircraft

[Docket No. 74-09; Notice 16]

ACTION: Final rule.

SUMMARY: This rule amends the inversion test added to Standard No. 213, *Child Restraint Systems*, to allow those manufacturers which choose to do so to certify their restraints for use in both motor vehicles and aircraft. These amendments specify more objective criteria for the testing procedures and determining compliance with the inversion tests. This rule adopts what was proposed, except that the rate of acceleration and deceleration at the start and finish of the test is now specified. The rule also specifically allows manufacturers the option of using any of the specified aircraft seats and safety belts. In addition, several typographical errors have been corrected.

EFFECTIVE DATE: April 17, 1985.

SUPPLEMENTARY INFORMATION: During the latter half of 1982, the Department of Transportation had two standards for child restraints. Child restraints for use in motor vehicles had to be certified as complying with the requirements of this agency's Standard No. 213 (49 CFR §571.213). That standard specifies performance and labeling requirements applicable to child restraints. Child restraints for use in aircraft had to be certified as complying with the requirements of the Federal Aviation Administration's (FAA) Technical Standard Order C100. That standard required child restraints to satisfy differing performance and labeling requirements if they were to be used in aircraft.

The result of these differing requirements was that only a few of the child restraints certified for use in motor vehicles were also certified for use in aircraft. In early 1983, the National Transportation Safety Board considered the safety problems posed for young children traveling in motor vehicles and aircraft and urged that a variety of actions be taken to promote increased use of child restraints. One of those recommendations was that the Department of Transportation simplify its two different standards setting forth requirements for child restraints, by combining the standards into a single standard.

After considering the benefits which would result from the increased use of child restraints, the FAA and NHTSA jointly concluded that the process of certifying child restraints for use in both motor vehicles and aircraft could and should be simplified and expedited. By combining the separate NHTSA and FAA standards into a single standard under the jurisdiction of a single agency, child restraint manufacturers could avoid the difficulties of dealing with different standards, methods of certification, and test procedures promulgated by the two different agencies. Accordingly, a notice of proposed rulemaking (NPRM) was published at 48 FR 36849, August 15, 1983.

This notice proposed that NHTSA would be the sole agency responsible for administering the new Standard No. 213, which would be applicable to both child restraints designed for use in motor vehicles and child restraints designed for use in aircraft. In essence, the notice proposed that the requirements in both agencies' standards be adopted *in toto* and simply combined in an expanded version of Standard No. 213. This would eliminate the problems inherent in dealing with the differing certification and testing procedures of the two agencies and consolidate all the requirements into one standard.

After publication of the NPRM, NHTSA and FAA undertook a joint testing program of all 42 models of child restraints being manufactured at that time and certified as complying with the requirements of Standard No. 213. The purpose of the joint testing program was to determine whether these child restraints could also be certified as complying with the FAA standard for child restraints for use in aircraft. The joint testing program showed that some of the FAA requirements proposed to be added to Standard No. 213 were simply less severe tests of performance capabilities which had already been measured in testing to satisfy the NHTSA requirements. Hence, those requirements were deemed redundant and not necessary to ensure adequate protection of restraint occupants in aircraft.

NHTSA published a final rule amending Standard No. 213 at 49 FR 34357, August 30, 1984. That rule added one additional test to Standard No. 213 which had to be satisfied by those child-restraint manufacturers which chose to certify their products for use in both motor vehicles and aircraft. The additional test was an inversion test, whose purpose is to ensure that child restraints certified for use in aircraft adequately protect occupants against the dangers posed by sudden air turbulence. The procedures to be followed were adopted exactly as proposed in the NPRM, which was in turn drawn verbatim from the FAA standard.

A number of the comments received in response to the NPRM agreed with the proposal to include an inversion test in Standard No. 213, but questioned the "vagueness and subjectivity" associated with the inversion test as proposed. After reviewing both the proposed criteria and the comments received on that proposal, NHTSA concluded that the test procedure should be clarified. However, the rulemaking procedures of the Administrative Procedure Act (5 U.S.C. 551 *et seq.*) precluded the agency from adopting the modifications to the test procedure in the final rule. This was because 5 U.S.C. 553 requires that interested persons receive notice of proposed rulemaking, and that such notice shall include either the terms or substance of the proposed rule or a description of the subjects and issues involved. The NPRM did not give the public notice that NHTSA was even considering different criteria from those which were proposed, so the final rule could not adopt such criteria.

To correct this perceived shortcoming of the final rule, NHTSA published another NPRM on the same day as the final rule, at 49 FR 34374, August 30, 1984. That notice proposed to establish the procedures and criteria used by NHTSA and the FAA in the joint testing program as the procedures and criteria to be followed in the inversion test just added to Standard No. 213. Only one commenter responded to this NPRM.

This notice proposed that to prepare for the inversion test, the subject child restraint should be attached to a representative aircraft passenger seat using only an FAA-approved aircraft safety belt and FAA-approved aircraft safety-belt extensions, if needed. A representative aircraft passenger seat was defined as either an FAA-approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Figure 6.

The commenter stated that this procedure failed to specify objective criteria, as required by section 102(2) of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1391(2)), because it was not clear that every FAA-approved production passenger seat is the equivalent of the simulated passenger seat shown in Figure 6. In the same vein, the commenter argued that it was not clear that all FAA-approved safety belts and safety belt extensions were equivalent for the purposes of the inversion test. If they are not equivalent, the commenter argued, the outcome of the inversion test would depend on the particular seat and/or safety belt chosen for the tests. When the outcome of the test is influenced by something other than the properties of what is being tested, the test is not objective. To remedy this, the commenter urged that the inversion test be amended to either specify the exact seat and safety-belt combinations which would be used for testing or specify that the seat and safety belts may be chosen at the manufacturer's option from among any of the specified seats and safety belts.

The inversion test in Standard No. 213 is a qualitative test, the results of which are mainly dependent upon the geometry of the aircraft seat and safety-belt combination. The test results will not be significantly affected by the seat's structural and padding characteristics or by the seat-belt properties. Nevertheless, the commenter is correct in asserting that the properties of the particular aircraft seat and safety belt used in a test *might* make the difference between the restraint passing and failing the test in a very marginal

case. The agency wishes to emphasize that this is a possibility, but it has not been demonstrated. In the joint testing program in which all currently produced models of child restraints were tested, all restraints passed the inversion test, using the criteria adopted in this rule.

To address this possibility, the rule adopts the commenter's suggestion that the proposed language be amended to specify that childs restraint manufacturers may at their option select any of the specified passenger seats and aircraft safety belts for use in the inversion test. A complete listing of all FAA-approved aircraft passenger seats and safety belts can be found in the FAA's Advisory Circular AC 20-36, which is updated annually. By adopting this approach, NHTSA is assuming that the simulated passenger seat shown in Figure 6 and each of the FAA-approved passenger seats are equivalent for the purposes of the inversion test, and that the slight differences between those seats will not make a difference in whether a restraint passes or fails the inversion test. A similar assumption is made with respect to each of the FAA-approved safety belts. The agency has adopted a similar approach in some other standards. *See, e.g.*, S3 of Standard No. 214, *Side door strength* (49 CFR §571.214). Should the agency assumption of equivalence be shown to be incorrect, NHTSA would amend the standard to specify those seats and safety belts which must be used for the inversion test. However, there is no reason to be that restrictive at this time.

Once the child restraint and test dummy have been secured in place in the representative aircraft passenger seat, the notice proposed that the seat be rotated around a horizontal axis at a rate of 35 to 45 degrees per second to an angle of 180 degrees, and the rotation would be stopped when it reached an angle of 180 degrees. The commenter stated that this language was indefinite because it did not specify the starting acceleration and stopping deceleration for the rotation. The commenter stated that the test would be more severe if the rotation were begun with a sudden jerk and halted by banging the combination against a stop positioned at 180 degrees than if it were started and stopped more gradually. However, the proposed language does not indicate which of these procedures is to be used for the testing.

NHTSA agrees with the commenter on this point, and the language of this final rule specifies that the inversion test should be conducted to allow not less than 1/2 second and not more than 1 second for the seat to achieve the required rate of rotation and to be stopped from that rate of rotation. These rates of acceleration and deceleration were the ones used in the NHTSA-FAA joint testing program.

The commenter also stated that there were some minor typographical errors in section S8.2.3, S8.2.4, and S8.2.5, and that the explanatory language beneath Figure 6 needed to be slightly clarified. NHTSA has made each of these requested changes in this final rule.

As discussed above, NHTSA has decided to clarify the test procedures and criteria for determining compliance with the inversion test specified in Standard No. 213. These requirements of this inversion test are optional, and need only be followed by those manufacturers which choose to certify their child restraints for use in aircraft as well as in motor vehicles. Manufacturers which choose to certify their products only for use in motor vehicles will not be adversely affected by an early effective date for these amendments. The amendments made by this notice do not change the fundamental performance requirement that those manufacturers which choose to also certify their products for use in aircraft will have to meet; the amendment benefits the manufacturers by clarifying the test procedure. Accordingly, I find good cause for making the amendments in this rule effective upon publication in the *Federal Register*.

The NHTSA has analyzed this rule and determined that it is neither "major" within the meaning of Executive Order 12291 nor "significant" within the meaning of the Department of Transportation regulatory policies and procedures. No additional requirements are imposed for restraints to be certified for use in aircraft, and no additional requirements are imposed for those restraints to be certified only for use in motor vehicles. These amendments simply clarify the testing procedures to be followed for child restraint systems which the manufacturer chooses to certify for use in aircraft. Since the impacts of this rule are minimal, full regulatory evaluation has not been prepared.

In consideration of the foregoing, 49 CFR Part 571.213 is amended to read as follows:

1. Paragraph S4 is amended by revising the definition of "representative aircraft passenger seat" to read as follows:

"Representative aircraft passenger seat" means

either a Federal Aviation Administration-approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Figure 6.

2. Paragraph S8 is revised to read as follows:

S8. *Requirements, test conditions, and procedures for child-restraint systems manufactured for use in aircraft.*

Each child-restraint system manufactured for use in both motor vehicles and aircraft must comply with all of the applicable requirements specified in section S5 and with the additional requirements specified in S8.1 and S8.2.

S8.1. *Installation instructions.* Each child-restraint system manufactured for use in aircraft shall be accompanied by printed instructions in the English language that provide a step-by-step procedure, including diagrams, for installing the system in aircraft passenger seats, securing the system to the seat, positioning a child in the system when it is installed in aircraft, and adjusting the system to fit the child. In the case of each child restraint which is not intended for use in aircraft at certain adjustment positions, the following statement, with the manufacturer's restrictions inserted, shall be included in the instructions.

DO NOT USE THE --- ADJUSTMENT POSITION(S) OF THIS CHILD RESTRAINT IN AIRCRAFT.

S8.2. *Inversion test.* When tested in accordance with S8.2.1 through S8.2.5 and adjusted in any position which the manufacturer has not, in accordance with S8.1, specifically warned against using in aircraft, each child-restraint system manufactured for use in aircraft shall meet the requirements of S8.2.1 through S8.2.6. The manufacturer may, at its option, use any seat which is a representative aircraft passenger seat within the meaning of S4.

S8.2.1. A representative aircraft passenger seat shall be positioned and adjusted so that its horizontal and vertical orientation and its seat-back angle are the same as shown in Figure 6.

S8.2.2. The child-restraint system shall be attached to the representative aircraft passenger seat using, at the manufacturer's option, any Federal Aviation Administration-approved aircraft safety belt, according to the restraint manufacturer's instructions for attaching the restraint to an aircraft seat. No supplementary anchorage belts or tether straps may be attached; however, Federal Aviation Administration-approved safety-belt extensions may be used.

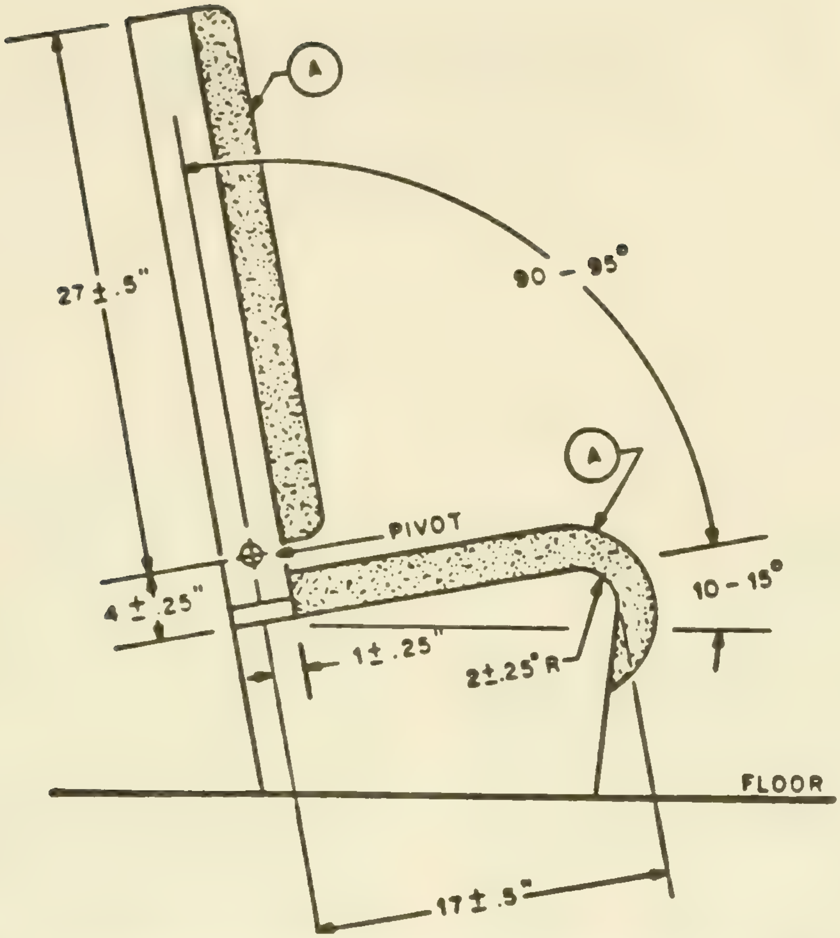
S8.2.3. In accordance with S6.1.2.3.1 through S6.1.2.3.3, place in the child restraint any dummy specified in S7 for testing systems for use by children of the heights and weights for which the system is recommended in accordance with S5.5 and S8.1.

S8.2.4. If provided, shoulder and pelvic belts that directly restrain the dummy shall be adjusted in accordance with S6.1.2.4.

S8.2.5. The combination of representative aircraft passenger seat, child restraint, and test dummy shall be rotated forward around a horizontal axis which is contained in the median transverse vertical plane of the seating-surface portion of the aircraft seat and is located 1 inch below the bottom of the seat frame, at a speed of 35 to 45 degrees per second, to an angle of 180 degrees. The rotation shall be stopped when it reaches that angle and the seat shall be held in this position for 3 seconds. The child restraint shall not fall out of the aircraft safety belt nor shall the test dummy fall out of the child restraint at any time during the rotation or the 3-second period. The specified rate of rotation shall be attained in not less than ½ second and not more than 1 second, and the rotating combination shall be brought to a stop in not less than ½ second and not more than 1 second.

S8.2.6. Repeat the procedures set forth in S8.2.1 through S8.2.4. The combination of the representative aircraft passenger seat, child restraint, and test dummy shall be rotated sideways around a horizontal axis which is contained in the median longitudinal vertical plane of the seating-surface portion of the aircraft seat and is located 1 inch below the bottom of the seat frame, at a speed of 35 to 45 degrees per second, to an angle of 180 degrees. The rotation shall be stopped when it reaches that angle and the seat shall be held in this position for 3 seconds. The child restraint shall not fall out of the aircraft safety belt, nor shall the test dummy fall out of the child restraint at any time during the rotation or the 3 second period. The specified rate of rotation shall be attained in not less than ½ second and not more than 1 second, and the rotating combination shall be brought to a stop in not less than ½ second and not more than 1 second.

3. A new Figure 6 would be added at the end of § 571.213, appearing as follows:



"A" represents a 2- to 3-inch thick polyurethane foam pad, 1.5 to 2.0 pounds per cubic foot density, over 0.020-inch-thick aluminum pan, and covered by 12- to 14-ounce marine canvas. The sheet-aluminum pan is 20 inches wide and supported on each side by a rigid structure. The seat back is a rectangular frame covered with the aluminum sheet and weighing between 14 and 15 pounds, with a center of mass 13 to 16 inches above the seat pivot axis. The mass moment of inertia of the seat back about the seat pivot axis is between 195 and 220 ounce-inch-second^2. The seat back is free to fold forward about the pivot, but a stop prevents rearward motion. The passenter safety belt anchor points are spaced 21 to 22 inches apart and are located in line with the seat pivot axis.

FIGURE 6: SIMULATED AIRCRAFT PASSENGER SEAT

Issued on April 10, 1985.

Diane K. Steed
Administrator

50 FR 15154
April 17, 1985

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems
[Docket No. 74-09; Notice 18]

ACTION: Final rule.

SUMMARY: This rule amends Standard No. 213, *Child Restraint Systems,* with respect to the requirements applicable to buckles used in child restraints. The requirement regarding the force necessary to operate the buckle release mechanism in the pre-impact test is changed from the previous minimum level of 12 pounds to a range between 9 and 14 pounds. The maximum release force for the buckle release in the post-impact test is reduced from the previous level of 20 pounds to 16 pounds. Additionally, this rule adds buckle size and buckle latching requirements to the standard. The effect of this rule is to ensure that child restraint buckles are easier for adults to operate, while still ensuring that small children will not be able to open the buckles by themselves.

EFFECTIVE DATE: February 18, 1986.

SUPPLEMENTARY INFORMATION: As an initial step toward ensuring that child restraint systems would offer adequate protection for their occupants, NHTSA issued Standard No. 213 in 1970. That version of the Standard required, among other things, that the buckle release mechanism operate when a force of not more than 20 pounds was applied.

NHTSA issued a new Standard No. 213, *Child Restraint Systems* (49 CFR §571.213) at 44 FR 72131, December 13, 1979. This new Standard substantially upgraded the performance requirements for child restraint systems. It also specified that the buckles must not release when a force of less than 12 pounds was applied to the buckle before conducting the dynamic systems test required by section S6.1 of Standard No. 213 and must release when a force of not more than 20 pounds was applied after conducting that dynamic systems test. The test for measuring the amount of force needed to release the buckle was to be conducted in accordance with the procedures set forth in section S6.2 of the standard. The purpose of the buckle force requirements is to prevent young children from unbuckling the restraint belt(s), while allowing adults to do so easily.

After the adoption of the standard, the agency received information indicating that the minimum force level needed to release the buckles was too high to permit many adults to easily release the buckles. Some of the buckles tested in the field required more than 20 pounds of pressure to release, according to a report done for the agency by K. Weber and N. P. Allen (Docket No. 74-09-GR-120). This same report concluded that even a force of 20 pounds is difficult for most women to generate with one hand. The agency has also been provided with consumer letters received by one child restraint manufacturer commenting on the difficulty of operating the child restraint harness buckles. The agency itself has received numerous telephone calls from consumers complaining about the size of the release buttons on child restraint belts and the high force levels required to operate them.

The agency's safety concerns over child restraint buckle force release and size stem from the need for convenient buckling and unbuckling of a child and, in emergencies, to quickly remove the child from the restraint. This latter situation can occur in instances of post-crash fires, immersions, etc. A restraint that is difficult to disengage, due to the need for excessive buckle pressure or difficulty in

operating the release mechanism because of a very small release button, can unnecessarily endanger the child in the restraint and the adult attempting to release the child.

This amendment is also intended to reduce the everyday misuse rate of child restraint harness and shields. Several studies conducted by Goodell-Grives, Inc., under contract to NHTSA indicate that the harness and shield misuse rate for infant and toddler restraints is between 25 and 40 percent. According to this study and others, misused child restraints may not only fail to protect the child in a crash situation, but may increase injury severity. The December 1984 study asked parents why they were apparently misusing the harness and shields. The misuse did not result from the lack of knowledge about the proper use of the harness and shields, because 95 percent of those parents knew the child restraint was being used incorrectly. Although the buckles were not cited directly, the inconvenience of the harness and shield operation was the most frequent reason given for misuse. This amendment will improve the operational convenience of the harness and shield buckles and thus should increase the correct usage rate of child restraint systems.

Accordingly, NHTSA published a notice of proposed rulemaking (NPRM) at 48 FR 20259, May 5, 1983, which proposed several changes to the buckle release force measurement test procedures. Those changes were intended to facilitate the use of buckles which would require approximately 10 1/2 pounds of force to release. The buckle force release test procedure specified that the buckle was to be tested both before and after the impact testing of the child restraint. In both the pre- and post-impact tests, tension was applied to the buckle prior to measuring the buckle release force. The purpose of applying tension was to simulate the force that would be applied to the buckle by a child hanging upside down in the child restraint.

The first proposed change was to eliminate the tension applied to the buckle in the pre-impact test. While it was considered appropriate for the post-impact test to simulate tension which would be present on the buckle in the event of a rollover crash, it was tentatively concluded that there were no forces whose presence ought to be simulated in the pre-impact test. Therefore, the notice proposed to measure the buckle release force in the pre-impact test with no load applied to the belt buckle, except the load exerted by properly adjusting the belt system around a child.

The second proposed change was to reduce the minimum buckle force permitted in the pre-impact test by three pounds, from 12 pounds to 9 pounds. According to the evidence available to the agency, a minimum buckle force level of 9 pounds is sufficient to prevent children up to the age of approximately 4 from opening the buckle by themselves. Further, the notice proposed to set a force of 12 pounds as the maximum force permitted in the pre-impact test. The NPRM specifically sought comments on whether this 3-pound range was sufficient to account for the amount of buckle force variation which inevitably arises from mass production manufacturing techniques.

The third change was proposed for the post-impact testing of the buckles. The tension previously specified in the standard would still be applied to the buckles before the release force was measured. However, the maximum force needed to release the buckles was proposed to be reduced from 20 pounds to 16 pounds. A higher force level is specified in the post-impact test as compared to the pre-impact test to allow for damage which could occur to the buckles during an actual crash and to allow for the additional belt loading which is possible from a child suspended upside down in the restraint system. The proposed lowering of the maximum force level was intended to permit a large portion of adults to more easily and quickly release the buckle in normal use (thus encouraging routine correct use of the restraints which would provide enhanced child safety) and in emergency post-crash situations.

The NPRM also proposed a change to Standard No. 213 in response to complaints about instances where a child restraint buckle was seemingly securely fastened by a parent, but subsequently popped open. This problem is commonly referred to as false latching. To address this problem, the NPRM proposed to require that child restraint buckles meet the latching requirements in section S4.3(g) of Standard No. 209, *Seat Belt Assemblies.* These requirements ensure that the design and construction of the buckle release mechanism are sufficiently durable to permit repeated latching and unlatching of the buckle and that the buckle releases when it is falsely latched and a minimum force (in this case, 5 pounds) is applied to it.

The final change proposed in the NPRM related to the size of the buckle release area. The agency believed that some of the problems experienced by parents in fastening and unfastening the child restraint buckles might be attributable to the size

of the buckle release mechanism. For instance, the smaller the area of a push button release mechanism, the more difficult it would be to use more than one finger, and hence apply a greater force, to open the buckle. The release mechanisms on some buckles were too small to allow sufficient engagement area for easy release of the buckle, particularly for persons with large hands. Most child restraint buckles use push buttons to release the buckle, so the NPRM proposed that push buttons have a minimum area of 0.6 square inch. The minimum surface area requirements applicable to motor vehicle seat belts were specified for other types of release mechanisms used on child restraint buckles.

The NPRM also requested comments on regulatory and non-regulatory ways in which the issues of belt length and shell width could be addressed. This request was based on the Weber and Allen report referenced above which raised questions about the length of the harness webbing used in child restraints and the seating width of the shells. The researchers noted that use of winter clothing significantly increases the amount of harness webbing needed to accommodate a fully clothed child. They reported that a snowsuit can add six inches to the length necessary for a harness lap belt to accommodate a child. Further, the researchers said that nearly all child restraints are too narrow for the size children they claim to accommodate.

The agency received 16 comments on the NPRM, and the commenters included private citizens, safety advocacy groups, child restraint manufacturers, and the National Transportation Safety Board. All these comments were considered in developing this final rule, and the most relevant ones are specifically addressed in the following discussion.

Pre-Impact Test Buckle Release Force Limit. In the NPRM, the agency specifically sought comments on the feasibility of manufacturing buckles within the 3-pound range. Many of the commenters objected to the proposed 9- to 12-pound release force limits, primarily because the 3-pound range was said to be too narrow based on current manufacturing techniques, to ensure that all buckles would comply with the proposed requirement. Some of these commenters asserted that the proposed 3-pound range would cause the buckle manufacturers to increase buckle prices in order to recoup the costs of the changes in manufacturing techniques and quality control which would have to be implemented to satisfy the proposed requirement. One child restraint manufacturer offered a statistical analysis of buckle release force tests in an effort to demonstrate the difficulty of maintaining a 3-pound range with current buckle manufacturing techniques. The manufacturer indicated that buckle release forces can vary up to 3- times the standard deviation for a given sample. The standard deviation for current production buckles is sufficiently large that, given a mean of 10.5 pounds and a range of 3 pounds, some buckles would have release forces outside the range. A different manufacturer submitted data from tests of current buckle designs showing that the release force can vary by as much as 6 pounds for current buckles. Finally, several commenters objected to the proposed 9-pound minimum release force on the grounds that buckles manufactured in compliance with the Canadian child restraint standard, which specifies an 8-pound minimum release and 16-pound maximum release force, would not satisfy the proposed U.S. standard. These commenters further stated that NHTSA should use this opportunity to harmonize this requirement with the Canadian standard.

In response to these comments, NHTSA has reconsidered its proposed 9- to 12-pound range for the buckle release force permitted in the pre-impact testing. The agency has concluded that a 3-pound range in release force would not be feasible with current manufacturing techniques, and the benefits of narrowing the feasible range to 3 pounds do not warrant requiring a change in current manufacturing techniques.

The only research study of which the agency is aware, examining the most appropriate release force range for child restraint buckles, is entitled "Child Restraint Systems," published in 1976 by Peter Arnberg of the National Swedish Road and Traffic Institute. This study, which is available in the General Reference section of Docket No. 74-09, presented the results of testing 80 children aged 2 1/2 to 4 1/2 years and 200 women. This study concluded that child restraint buckles should have a release force of 40 to 60 Newtons (approximately 9 to 13 1/2 pounds).

After analyzing the comments, NHTSA has determined that a 5-pound range in buckle release force is needed to allow for current buckle manufacturing techniques. Based on this determination and the recommendations of the Arnberg study, this rule requires child restraint buckles to have a release force of between 9 and 14 pounds before the buckles are subjected to dynamic testing.

The agency notes that this rule is not precisely harmonized with the Canadian standard for child restraint buckle release forces, which specifies a minimum release force of 8 pounds before dynamic testing and a maximum release force of 16 pounds after dynamic testing. NHTSA has adopted a 9 pound minimum release force because of its concern that 3 1/2- to-4-year-old children could open their child restraint buckles if the release force were 8 pounds, as shown in the Arnberg study. Further, the 14-pound maximum release force before dynamic testing was added in this rule because buckles with a release force of more than 14 pounds are difficult for many women to open in everyday use, as demonstrated in the Arnberg study. The result of these differing requirements in the United States and Canada is that buckles which comply with the Canadian buckles force requirements will not automatically comply with Standard No. 213. However, buckles which comply with Standard No. 213 will also comply with the buckle force requirements of the Canadian standard.

Pre-Impact Buckle Test Procedure. The NPRM proposed a new procedure for this test. The same procedures have been used for measuring the buckle release force in both the pre-impact and the post-impact testing. Briefly stated, the child restraint is installed on a standard seat assembly, the dummy is positioned in the child restraint, a sling is attached to each wrist and ankle of the dummy, and the sling is pulled by a designated force. As noted above, the presence of the dummy and the force applied to the sling simulate a rollover crash situation.

The NPRM proposed, and this final rule adopts, a new test procedure for the pre-impact testing, because there is no need to simulate a rollover crash situation before impact. The NPRM proposed placing the buckle on a hard, flat surface and loading each end of the buckle with a force of 2 pounds before measuring the force required to release the buckle. None of the commenters objected to this basic change in the test procedure, and it is adopted for the reasons stated in the NPRM.

Several commenters did object to the release force application device, which was proposed as a rigid, right-circular cone with an enclosed angle of 90 degrees or less. This device would be used to transfer the release force to the push button release. Some commenters argued that this device would not adequately represent real-world push button actuation. Specifically, they were concerned that the pointed device applies the release force over an area considerably smaller than that of a finger or thumb. Other commenters argued in favor of a different release force application device, contending that this device would permanently deface some of the tested buckles.

NHTSA has decided to adopted the proposed conical test device. Its small contact area allows accurate positioning on the release button, which will yield consistently repeatable test results. The buckle release force test procedures proposed in the NPRM, as modified for this final rule, were conducted by the Calspan Corporation in July 1984 during the annual FMVSS No. 213 compliance test procedures. On the basis of these tests, the agency concluded that the amended test procedures simulate real-world actuation of push button release mechanisms because the release force is applied in a manner similar to hand operation and tests with several alternative devices indicated that conical devices produce release force values consistent with those generated by different probes. Manufacturers choosing to test a large number of buckles to be used on their child restraints can place a protective surface between the button and the test device to prevent defacing of the buckles. Those manufacturers who want to use an alternative test device are free to do so, provided that they can correlate the results obtained with that alternative device with results obtained with the specified test device, which will be used by the agency in compliance tests.

The NPRM proposed that the force applied by the test device be "at the center line of the push button 0.125 inches from a movable edge and in the direction that produces maximum releasing effect." Many commenters argued that this procedure needed to be refined to take account of the different release mechanisms. One commenter stated that there are two different types of push button release mechanisms, hinged and floating. A hinged button has one fixed edge and release forces applied near the fixed edge may not activate the release mechanism. Instead, the hinged button is designed to release when force is applied near the center of the button or toward the edge opposite the fixed edge. On the other hand, the floating button has no fixed edges and is designed to release when force is applied near the center of the button. This commenter noted that, while the force application proposed in the NPRM may be suitable for hinged buttons, it would be inappropriate for floating buttons.

The agency agrees with the commenters that some further refinements should be made to the test procedures to account for the different types of push buttons. Accordingly, this rule specifies that, for hinged buttons, the force shall be applied according to the procedures proposed in the NPRM. For floating buttons, the force shall be applied at the geometric center of the button. These differing force application points will take into account the differing designs of push buttons, without favoring one or the other design.

Several commenters stated that the NPRM failed to specify any test procedures for buckles designed for the insertion of two or more buckle latch plates, even though a number of buckles on current models of child restraints are designed to secure more than one belt. Further, these commenters noted that, while the NPRM did specify a 2-pound pre-load force should be applied to buckles before conducting the pre-impact buckle release test, it failed to specify the direction in which the force should be applied. To remedy these perceived shortcomings, some of the commenters recommended that the final rule specify that the 2-pound pre-load force be applied along the direction of the latch plate insertion for single latch plate buckles and that the 2-pound force be divided by the number of latch plates and the resultant force applied to each latch plate in the direction of latch plate insertion for multiple latch plate buckles. This final rule adopts this recommendation. The NPRM's intent was that the force be applied along the direction of latch plate insertion, and it is appropriate to make this intent explicit in this final rule. Further, the one pound pre-load force for multiple latch plate buckles is sufficient force to simulate the tension which would be present in properly adjusted belts, yet small enough so as not to simulate other forces which would not be present in normal everyday use.

Along these lines, one commenter suggested that the pre-load force be increased from two to five pounds. This commenter stated that the proposed pre-load force of 2-pounds might not be sufficient to release the buckles, while the 5-pound load would assure that the buckles always release. Further, the commenter noted that Standard No. 209 allows a false latching load of 5-pounds maximum, and that this change would make the two Standards consistent.

NHTSA is not persuaded by these comments, and has not incorporated the suggested change in this final rule. For the pre-impact buckle release force test procedure, the 2-pound pre-load is designed to simulate the separation tension in the harness restraint system during normal use and approximate the buckle loading on a restraint system adjusted for the compliance impact test.

Section S5.2(g) of Standard No. 209, on the other hand, is not intended to approximate forces present during normal buckle operation. That section requires that the buckle latching mechanism be tested for durability and then the latch plate or hasp inserted in any position of "partial" engagement (false latching). When the buckle and latch plate are in this position of "induced" partial engagement, a force of 5 or less shall separate the latch plate from the buckle. The separation of the latch plate is affected without operating the release mechanism. Since this procedure is not intended to simulate normal buckle operation but to test the susceptibility of the buckle to false latching, it would not be appropriate to incorporate its loading into Standard No. 213.

Post-Impact Buckle Test Procedure. As noted above, the NPRM proposed to reduce the maximum force needed to release the buckle after it had been subjected to the impact test from the 20-pound level currently specified to 16 pounds. A higher release force is specified for the post-impact test to account for damage which might occur to the buckle during the impact test and to counter the forces which could be exerted on the buckle by a child hanging upside down in rollover crash conditions. The reason for proposing the lower force was that it was sufficient to account for damage which might occur to the buckle, and such force can be generated by almost all women using only one hand, according to the Arnberg study. The current 20-pound force requirement allows buckles which require two-hand operation by many adults, and two-hand operation is often awkward and may adversely affect safety in emergency situations. The agency notes that the Canadian standard also specifies a maximum post impact force of 16 pounds. No commenters objected to this proposed change, and it is adopted herein for the reasons explained above.

The preamble to the NPRM did not discuss any other changes to the post-impact testing procedure, because the agency did not intend to propose any changes other than reducing the maximum release force for the buckles. However, section S6.2.2 of Standard No. 213 as published in the NPRM indicated that the self-adjusting sling which is

attached to the dummy to simulate a rollover crash situation should be attached only to the dummy's ankles. The Standard currently requires the sling to be attached to the dummy's *wrists* and ankles, and this requirement was inadvertently omitted from the NPRM language. This final rule corrects this omission, so no change is specified for the post-impact testing except the reduction in buckle release force.

Buckle Latching. The NPRM proposed adding the latching performance requirements of sections S4.3(g) and S5.2(g) of Standard No. 209 to Standard No. 213. These procedures test the latching performance of seat belt buckles to ensure that the buckle materials and structure will operate properly after numerous cycles of latchings and unlatchings. As explained in the NPRM, this step should reduce or eliminate the false latching problems experienced by child restraint users. False latching occurs when buckles are apparently latched, but then subsequently pop open. NHTSA believes that most of the false latchings result from poorly designed or cycle degraded latching mechanisms, and that the Standard No. 209 requirements will eliminate latching mechanisms which are poorly designed or subject to cycle degradation.

Most of the commenters who addressed this proposal supported its adoption, although several commenters stated that additional requirements may be needed to ensure that false latching does not continue to be a significant problem. The National Transportation Safety Board stated that it had evidence that brand-new child restraint buckles, not yet subject to material wear, are prone to false latching, and that additional requirements along the lines of the European requirement that latchplates be ejected by a spring located in the buckle when the buckle is not properly latched, may be necessary to prevent false latching. Other suggestions from the commenters included requiring the use of color-coded push buttons to show when the buckle was properly latched and requiring specific warnings in the manufacturer's instruction manuals urging parents to check for false latchings every time they fasten the buckles.

NHTSA has adopted the requirements proposed in the NPRM to reduce the false latching problems. The agency believes that the Standard No. 209 seat belt buckle tests will identify buckles which are subject to false latchings because of materials wear or poor design, because false latching complaints by consumers have been eliminated for motor vehicle seat belts and the agency expects that these tests will substantially reduce this problem for child restraint buckles as well. The agency will continue to monitor problems of false latchings, and will consider additional requirements to address that problem if necessary.

Buckle Size. The NPRM proposed to specify a minimum area for the buckle release mechanism, because some of the difficulties reported in opening child restraint buckles were believed to arise from the small size of the buckle release mechanism. As noted earlier, the smaller the area of the push button, the more difficulty there is in applying the forces which must be exerted to open the buckle. Those commenters who addressed this issue supported the proposed requirement that push buttons used on child restraints have a minimum release area of 0.6 square inch, and it is adopted in this final rule.

Belt Length/Shell Width. The NPRM solicited comments on steps which could be taken to address the issues of belt length and shell width. These issues arose after a research report noted that children clad in winter clothes need up to six additional inches of belt webbing, and that many current child restraints do not have this extra belt length. In addition, the report noted that nearly all child restraints are too narrow for the size children they claim to accommodate. The NPRM noted that a long-range solution was for the agency to use additional test dummies to simulate larger children. A possible short-term answer was to conduct the crash tests with the dummies clad in a typical snowsuit.

Several commenters stated that regulatory action was not needed in this area. Child restraint manufacturers generally believe that the industry will adjust belt length and shell width in response to consumer demand, and believe that any regulations at this time would only add costs and research burden without substantially benefiting child safety. The Physicians for Automotive Safety stated that the agency should approach those manufacturers with problems in these areas and request voluntary remedial action, instead of pursuing rulemaking. That group also stated that it knew of only one model of child restraint with problems along these lines. The National Transportation Safety Board stated that the agency should develop regulations in these areas.

Some of the commenters opposed the use of snowsuits on the test dummies because those

snowsuits would absorb some of the crash energy. According to these commenters, the agency would, in effect, reduce the severity of the crash tests by so dressing the test dummies.

In view of the above comments rulemaking will be deferred in this area. The agency will continue to monitor the issues of seat shell size and harness webbing length associated with infant and toddler restraints (40 pounds and below) to determine if rulemaking in this area will be necessary in the future.

Editorial Correction. Several commenters noticed that there was a typographical error in section S5.4.3.5(a) of the NPRM. That section referred to testing in accordance with section S6.2.2, while the correct reference was to section S6.2.1. This error is corrected in this final rule.

§571.213 [Amended]

In consideration of the foregoing, Title 49 of the Code of Federal Regulations is amended by revising §571.213 to read as follows:

1. The authority citation for 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, and 1407; delegation of authority at 49 CFR 1.50.

2. Section S5.4.3.5 is revised to read as follows:

* * * * *

S5.4.3.5 *Buckle Release.* Any buckle in a child restraint system belt assembly designed to restrain a child using the system shall:

(a) When tested in accordance with S6.2.1 prior to the dynamic test of S6.1, not release when a force of less than 9 pounds is applied and shall release when a force of not more than 14 pounds is applied;

(b) After the dynamic test of S6.1, when tested in accordance with S6.2.3, release when a force of not more than 16 pounds is applied;

(c) Meet the requirements of S4.3(d)(2) of FMVSS No. 209 (§571.209), except that the minimum surface area for child restraint buckles designed for push button application shall be 0.6 square inch;

(d) Meet the requirements of S4.3(g) of FMVSS No. 209 (§571.209) when tested in accordance with S5.2(g) of FMVSS No. 209; and

(e) Not release during the testing specified in S6.1.

* * * * *

3. Section S6.2 is revised to read as follows:

* * * * *

S6.2 *Buckle Release Test Procedure.* The belt assembly buckles used in any child restraint system shall be tested in accordance with S6.2.1 through S6.2.4 inclusive.

* * * * *

4. Section S6.2.1 is revised to read as follows:

* * * * *

S6.2.1. Before conducting the testing specified in S6.1, place the locked buckle on a hard, flat, horizontal surface. Each belt end of the buckle shall be pre-loaded in the following manner. The anchor end of the buckle shall be loaded with a 2-pound force in the direction away from the buckle. In the case of buckles designed to secure a single latch plate, the belt latch plate end of the buckle shall be loaded with a 2-pound force in the direction away from the buckle. In the case of buckles designed to secure two or more latch plates, the belt latch plate ends of the buckle shall be loaded equally so that the total load is 2 pounds, in the direction away from the buckle. For push-button release buckles the release force shall be applied by a conical surface (cone angle not exceeding 90 degrees). For push-button release mechanisms with a fixed edge (referred to in Figure 6 as "hinged button"), the release force shall be applied at the centerline of the button, 0.125 inches away from the movable edge directly opposite the fixed edge, and in the direction that produces maximum releasing effect. For push-button release mechanisms with no fixed edge (referred to in Figure 6 as "floating button"), the release force shall be applied at the center of the release mechanism in the direction that produces the maximum releasing effect. For all other buckle release mechanisms, the force shall be applied on the centerline of the buckle lever or finger tab in the direction that produces the maximum releasing effect. Measure the force required to release the buckle. Figure 6 illustrates the loading for the different buckles and the point where the release force should be applied, and Figure 7 illustrates the conical surface used to apply the release force to push-button release buckles.

* * * * *

5. Section S6.2.2 is revised to read as follows:

* * * * *

S6.2.2. After completion of the testing specified in S6.1, and before the buckle is unlatched, tie a self-adjusting sling to each wrist and ankle of the test dummy in the manner illustrated in Figure 4.

* * * * *

6. Section S6.2.4 is revised to read as follows:

*   *   *   *   *

S6.2.4. While applying the force specified in S6.2.3, and using the device shown in Figure 7 for push-button release buckles, apply the release force in the manner and location specified in S6.2.1 for that type of buckle. Measure the force required to release the buckle.

*   *   *   *   *

7. Section S6.2.5 is deleted.

8. Two new drawings (Figures 6 and 7) are added at the end of §571.213, appearing as follows:

Issued on August 15, 1985.

Diane K. Steed
Administrator

50 F.R. 33722
August 21, 1985

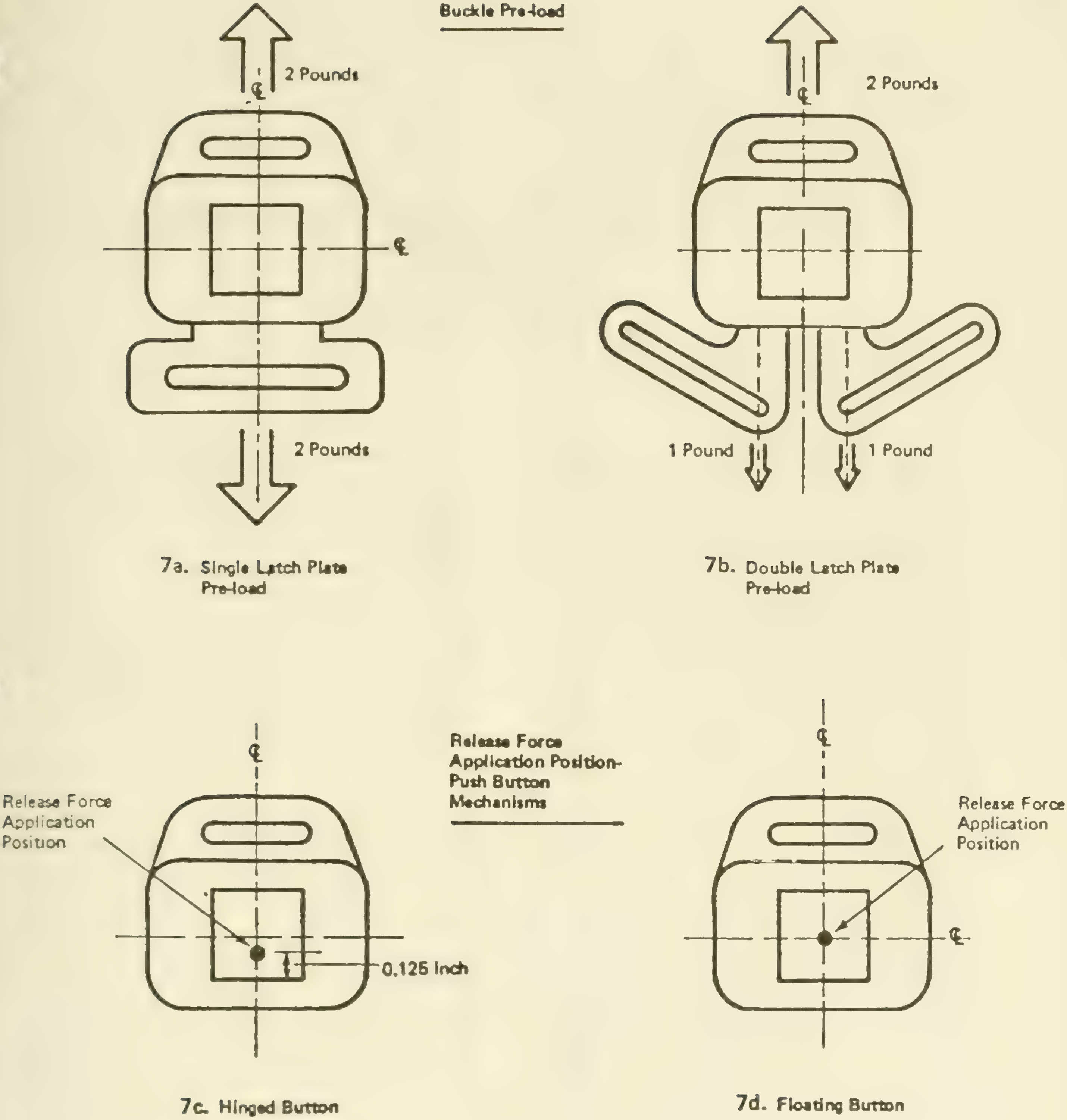


Figure 7. Pre-impact Buckle Release Force Test Set-up

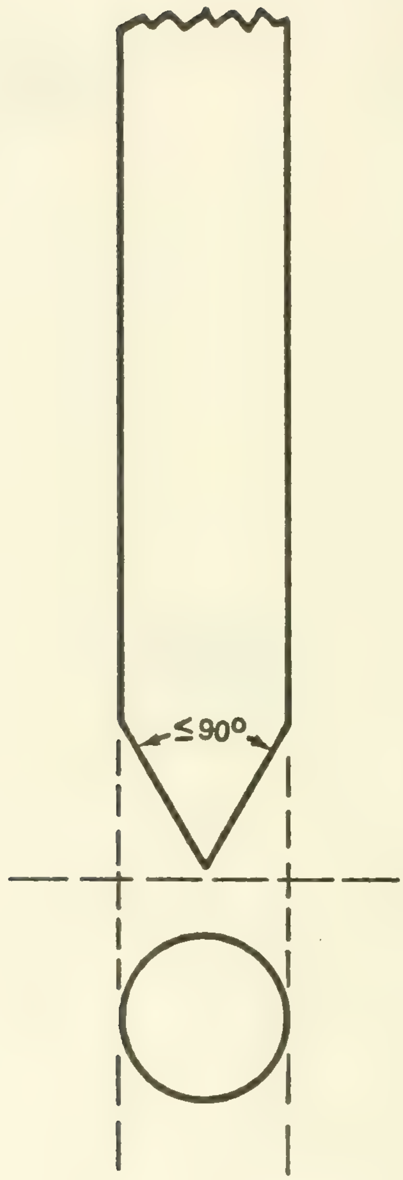


Figure 8. Release Force Application Device — Push Button Release Buckles

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems

(Docket No. 74-09; Notice 18)

ACTION: Final rule.

SUMMARY: This rule amends Standard No. 213, *Child Restraint Systems,* by requiring all child restraints equipped with tether straps (other than child harnesses, booster seats, and restraints designed for use by physically handicapped children) to pass the 30 miles per hour (mph) test with the tether strap unattached. This change is being made because survey results consistently show that, in the vast majority of instances, child restraints with tether straps are used by the public without attaching the tether strap to the vehicle. This amendment will ensure that children riding in child restraints with unattached tethers will be afforded crash protection equivalent to that afforded to children riding in child restraints designed without a tether.

This rule also eliminates the requirement that those child restraints pass a 20 mph test with the tether unattached. Since those restraints will now be required to pass the 30 mph test under the same test conditions, it is unnecessary for those restraints to also be tested at a low speed.

Finally, this rule clarifies two items of information required to be included in the instructions accompanying child restraints. These clarifications do not alter the amount of information that must be included in the instructions: they simply explain what the agency intended to require.

EFFECTIVE DATE: August 12, 1986.

SUPPLEMENTARY INFORMATION: Standard No. 213, *Child Restraint Systems* (49 CFR S571.213) currently provides two different test configurations applicable to child restraint systems. First, a 30 mph frontal crash test is conducted for all child restraints. In that test, the restraints are installed according to the child restraint manufacturer's instructions. This test is referred to as Test Configuration I in section S6.1.2.1.1 of Standard No. 213.

Second, a 20 mph test is conducted for two types of child restraint systems. One type is a child restraint equipped with an anchorage belt. Anchorage belts, more commonly referred to as tether straps, are supplemental belts under to attach the child restraint to the vehicle. The other type of restraint subject to the 20 mph crash test is a child restraint with a fixed or movable surface which helps to restrain the child's forward movement in the event of a crash. This type of child restraint provides protection by the use of its own belt system and a surface which can be used independently of the belt system. Both these types of child restraints are tested with only the vehicle lap belt holding the child restraint to the standard test seat and, in the case of restraints with a fixed or movable surface forward of the child, without attaching the restraint's belt system to hold the test dummy in place. This test, referred to as Test Configuration II in section S6.1.2.1.2 in Standard No. 213, is intended to take account of the possibility that the tether strap or the restraint's belt system will either be misused or not used at all by parents. If this happens, Test Configuration II should ensure that these types of restraints will offer minimal protection even when they are not properly used.

This rulemaking action addresses only the question of restraints with tether straps, and does not affect restraints with fixed or movable surfaces forward of the child. Tether straps have presented a difficult question for the agency since at least 1979. When a tether strap is properly attached, a child restraint equipped with a tether strap will generally offer the best protection for child occupants, particularly those riding in the front seat or involved in side impact crashes.

However, the results of surveys have continually shown that tether straps are not attached by the vast majority of the public. The most recent study available to the agency on this topic (Cynecki and Goryl, "The Incidence and Factors Associated with Child Safety Seat Misuse"; December 1984, DOT HS–806 676) found that nearly 85 percent of child restraints with tether straps were used without properly attaching the tether straps. The Cynecki and Goryl study recommended that the best solution for this problem would be to redesign the restraints to eliminate the need for tether straps.

This same suggestion had been made previously by several commenters in connection with the final rule substantially upgrading the performance requirements fo Standard No. 213; 44 FR 72131, December 13, 1979. At the time of that rulemaking action, however, restraints. The agency decided that it would be inappropriate to issue a rule which would have the effect of requiring a major redesign of most child restraint systems then on the market, especially when the public was just beginning to appreciate the importance of using child restraints. Further, NHTSA expected that proper usage of restraints with tethers would grow as public awareness and knowledge of child restraints grew.

When NHTSA reexamined this decision in light of the Cynecki and Goryl report, the reasoning no longer seemed valid. First, at this time, approximately one-fifth of all new child restraints, including booster seats, are equipped with a tether strap necessary for the protection of the child occupant. Thus, a rule which would have the effect of requiring a redesign of these restraints would have a substantially smaller impact on the child restraint market now than it would have had in 1979.

Second, and most significant, the expectation of increased proper use of tether straps has not been realized. Perhaps the most troubling fact in the Cynecki and Goryl report cited above was that 78 percent of the persons not using the tether strap to attach the child restraint to the vehicle *knew that its use was necessary.* This indicates that, while public awarness and knowledge of child restraints has grown significantly since 1979, that awareness and knowledge has not resulted in increased proper use of tether straps.

Because of its concern for the safety of children riding in motor vehicles, NHTSA tentatively decided that it was no longer reasonable to allow restraints with tethers to be tested in only a 20 mph crash in the way they will be used by the public, that is, without attaching the tether strap. The agency believed that those restraints, like restraints without tethers, should be tested in a 30 mph crash in the way they will be used by the public. This would ensure that all child restraints afforded equivalent protection to children riding therein.

Accordingly, NHTSA published a notice of proposed rulemaking (NPRM) on July 5, 1985; 50 FR 27633, proposing that all child restraints other than child harnesses be tested in the 30 mph crash test when attached to the test seat only by means of the lap belt. This proposal was intended to ensure that restraints with tethers afford the same level of protection to child restraint occupants as do restraints without tethers when tested in the manner both will be used by the public.

That NPRM also proposed some less significant changes to Standard No. 213. These were as follows:

(1) The standard currently specifies that the child restraint be installed in the center seating position during the testing. However, many new vehicles are produced without a front or rear center seating position. This trend raised the concern that the tests were growing less representative of the conditions which would be encountered by the child restraint when it was in use. Accordingly, the NPRM proposed to amend Standard No. 213 to require that child restraints be tested in one of the two outboard seating positions. An anticipated added benefit of this change would be that it would reduce testing costs for the child restraint manufacturers, because two child restraints could be evaluated in the same test.

(2) Standard No. 213 requires that all child restraints equipped with a tether strap be permanently lableed with a notice that the tether strap must be properly secured as specified in the manufacturer's instructions. The NPRM proposed that the phrase "For extra protection in frontal and side impacts" be added in front of that notice. This change would convey the fact that the tether strap was a supplementary safety device, as proposed in the NPRM, while also affirming that additional safety protection is afforded when the tether strap is properly attached.

(3) Two changes were proposed to clarify what was meant in the requirements concerning the in-

stallation instructions to be provided along with the child restraint by the restraint's manufacturer. These were:

(a) The installation instructions are currently required to state that, in most vehicles, the rear center seating position is the safest seating position for installing a child restraint. This statement in the instructions has resulted in numerous inquiries to the agency by consumers wanting to know the safest seating position for vehicles with only two rear outboard seating positions. To eliminate this confusion on the part of the public, the NPRM proposed that the installation instructions be modified to state that, for maximum safety protection, the child restraint should be installed in a rear seating position in vehicles with two rear seating positions and in the center rear seating position in vehicles with three rear seating positions.

(b) The installation instructions in Standard No. 213 also require that child restraint manufacturer to "specify in general terms the types of vehicles, seating positions, and vehicle lap belts with which the system can or cannot be used." This requirement has frequently been erroneously interpreted to mean that child restraint manufacturers are required to state the specific vehicles, specific seating positions, and the specific vehicle lap belts with which a child restraint manufacturers are required to state the specific vehicles, specific seating positions, and the specific vehicle lap belts with which a child restraint can or cannot be used. The NPRM proposed an amendment to make clear the agency's intent that the instructions specify the *types* of vehicles (e.g., passenger cars, pickup trucks, vans, buses, etc.), the *types* of seating positions (e.g., front, rear, bench, bucket, side facing, rear facing, folding, etc.) and the *types* of vehicle safety belts (e.g., diagonal, lap-shoulder, emergency locking, etc.) with which the restraint system can or cannot be used.

A total of 15 comments were received on the NPRM. The commenters included vehicle manufacturers, child restraint manufacturers, the National Transportation Safety Board, researchers from two state universities, child safety advocates, and individual consumers. Each of these comments was considered and the most significant ones are addresssed below.

Attaching Tether Straps During the 30 MPH Test and the Need for the 20 MPH Test

Before discussing the comments received on this issue, the most significant one raised in the NPRM, NHTSA believes it would be useful to explain the differences between the different types of child restraints.

1. *Child seats.* A child seat is a child restraint that uses a plastic shell as a frame around the child, and has a shield, belts, or the like attached to the shell to restrain the child in the event of a crash. All but one of the currently produced models of child seats do not need to have an attached tether strap to pass the 30 mph test. However, two of the models which do not need a tether strap to pass the 30 mph test offer a tether strap as an option for extra protection of the child restraint's occupant.

2. *Booster seats.* A booster seat is a platform used to elevate a child in a vehicle. It does not have a frame or any other structural protection behind the child's back or head. Booster seats are designed to be used by older children who have outgrown child seats. By elevating these children, the booster seat allows the child to see out of the vehicle and to use the belt system in the vehicle. About half the current production of booster seats uses a special harness system attached to the vehicle by a tether strap to provide upper torso restraint for the booster seat occupant. The other half of current production of booster seats uses a small shield in front of the child to provide upper torso restraint.

3. *Child harnesses.* A child harness consists of a web of belts which are placed around the child, and is then anchored to the vehicle by a tether strap. Only one model of child harness is currently in production. Child harnesses are tested only in the 30 mph test with the tether attached according to the manufacturer's instructions, and are not subject to the 20 mph test. The reason for this differing treatment for child harnesses are compared to other child restraints is the agency's opinion that child harness tethers are in fact properly used by the public, due to the nature of the device—i.e., if the tether strap is not attached, it would be obvious that the child would be completly unrestrained in the event of a crash.

4. *Restraints for use by physically handicapped children.* These restraints are essentially wheelchairs, some of which fold so that the wheelchair can be positioned in the rear seat of passenger cars. Other restraints are simply devices to tie down a wheelchair while the child is travelling in a van, bus, or similar vehicle. All currently produced child restraints for use by physically handicapped children use their own belt system and tether straps to provide the necessary upper torso restraint. The NPRM did not propose any exemp-

tion for these restraints from the proposed requirement that they pass the 30 mph test without attaching any tether straps. Thus, if the NPRM were adopted as proposed, all of these restraints would have to be redesigned.

This final rule establishes the following requirements for the different types of child restraints. Child seats will not be allowed to have any tether straps attached during the 30 mph test required by Standard No. 213. They will also no longer be required to be tested in the 20 mph test. However, child harnesses, booster seats, and restraints for use by physically handicapped children will be allowed to continue to have tether straps attached during the 30 mph test. The reasoning supporting these decisions is set forth below.

CHILD SEATS

Almost all of the commenters addressing the agency's proposal to require child seats equipped with tether straps to pass the 30 mph test without attaching the tether supported the requirement. The only commenter which opposed this requirement was a child restraint manufacturer, arguing that a change at this time would "cause confusion of dealers and consumers with units that required tethers". The manufacturer further argued that if this change were made, "the Federal government must given child restraint manufacturers some sort of security blanket to protect them from lawsuits and recall of existing units."

NHTSA does not believe it is very likely that either dealers or consumers will be confused by the requirement that child seats with tethers pass the 30 mph test with the tether strap unattached. The new requirement would apply only to child seats manufactured after the effective date of this rule. Child seats manufactured before the effective date of this rule may be sold even if their tether strap must be attached to pass the 30 mph test. Hence, the agency does not see any reason for child seat dealers to be confused by this rule. Moreover, the public will receive the manufacturer's instructions with the child seat explaining how it is to be used. Thus, there does not appear to be any reason for the public to be confused by this rule.

NHTSA does not have any authority to given restraint manufacturers a "security blanket" to protect them from lawsuits or recalls of child seats with tethers. Even if NHTSA believed it was appropriate to protect a manufactuer from lawsuits in a particular instance, only Congress has authority to do so. A recall of child seats must be based on a determination that the seats either do not comply with the requirements of Standard No. 213 in effect on the date of manufacture of the seat or that the seat contains a safety-related defect, as specified in sections 151 and 152 of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1411 and 1412). If either determinatioon were made, the manufacturer is required by Section 154 of the Safety act (15 U.S.C. S1415) to remedy the noncompliance or defect.

For the reasons set forth at length in the NPRM and briefly reiterated at the beginning of this preamble, and because only one child seat model is being produced that requires the tether strap to be attached, NHTSA is adopting the proposed requirement that all child seats pass the 30 mph test without any tether straps attached. This requirement applies to all child seats manufactured after the effective date of this rule.

As an adjunct to this rulemaking, child seats equipped with a tether strap will not longer be subject to the requirement that they also pass a 20 mph test with the tether unattached. Since these child seats will now be subject to the 30 mph test with tether unattached, no purpose would be served by requiring the seats to be tested in a less severe manner under the same conditions.

BOOSTER SEATS

The commenters split on the issue of whether booster seats should be required to pass the 30 mph crash test with the tether strap unattached. The Insurance Institute of Highway Safety, Chrysler Corporation, the National Transportation Safety Board, and two individuals supported the proposed requirements for the reasons explained in the NPRM. However, the National Child Passenger Safety Association, Physicians for Automotive Safety, the University of Michigan, and researchers associated with the University of North Carolina opposed the proposed requirement. The gist of these opposing comments was as follows: the only means currently available for providing the needed upper torso restraint to booster seat occupants is with either a tether strap and harness or with a short shield in front of the child. A requirement to pass the 30 mph test without an attached tether strap would force manufacturers to equip all booster seats with a short shield. These commenters were concerned about the adequacy of the safety protection afforded to booster seat occupants by these short shields.

The University of Michigan commented that it is currently engaged in a research program to develop an abdominal penetration sensor for the 3-year old dummy currently used in Standard No. 213 testing. They stated that they have undertaken this research because of their concern about the abdominal loading to which the short shield exposes the child during the 30 mph crash test. The University of Michigan concluded its comment by stating that its preliminary tests with a prototype of its abdominal penetration sensor suggests that children are in fact exposed to high abdominal loading by the short shields used on booster seats without tethers. The researchers associated with the University of North Carolina concurred with the University of Michigan on the need to examine the abominal loading associated with booster seats without tethers before mandating that all booster seats be capable of passing the 30 mph test without an attached tether.

The agency is also aware of other concerns which have been expressed by child safety researchers in connection with the short shields used in booster seats without tethers. For example, there is concern that older children could be seriously injured by having their head and neck wrap around the shield, since the shield is not large enough to restrain those parts of the body in a crash situation. This concern was raised in the comments submitted by the National Child Passenger Safety Association. Another concern is that the short shield booster seats do not provide any crotch restraint. It is possible that smaller children could submarine under the short shields on booster seats, leaving these children completely unrestrained in the event of a crash.

NHTSA wishes to emphasize that booster seats without tethers comply with all current requirements of Standard No. 213 using the 3-year old dummy. Nevertheless, the issues raised by the commenters regarding the effectiveness of short shields on booster seats are matters of concern to the agency. Since the short shields used on booster seats without tethers represent the only current alternative to the use of tether straps on booster seats, NHTSA has concluded that it would be an unwise policy to essentially require the use of short shields on booster seats (by adopting the proposed requirements) before the agency has investigated the validity of the above-mentioned safety concerns. If testing showed that short shields did not provide adequate safety protection to children after the agency had essentially required the use of such shields on all booster seats, this rulemaking would not achieve the agency's goal of improving the protection offered to child restraint occupants. Therefore, it is premature to adopt the proposed requirements as they apply to booster seats.

The agency will investigate the allegations that have been made about the short shields on booster seats. The agency investigation, together with the University of Michigan testing on the abdominal loading imposed by these short shields, should help resolve the stated concerns.

There is also an important distinction between child seats with tethers and booster seats with tethers, which suggests that it is not as imperative to require that booster seats not be permitted to have an attached tether strap during the 30 mph test. Booster seats equipped with tethers are designed to be used *either* with the tether strap attached to the vehicle *or* with a lap-shoulder belt. When a lap-shoulder belt in a vehicle so that it will provide the necessary upper torso support. When upper torso support is provided by a vehicle shoulder belt, it is not necessary to attach the tether strap to provide the necessary upper torso support.

This feature resulted in observed correct usage of booster seats equipped with tethers in 38.0 percent of the total cases in the Cynecki and Goryl report cited above. The tether strap was properly attached in 8.5 percent of the cases, and the lap-shoulder belt was correctly used with the booster seat in 29.5 percent of the observed cases. This 38.0 percent correct usage of booster seats with tethers compares favorably with the 41.2 percent correct usage of child seats not equipped with tethers, and both stand in sharp contrast to the 7.0 percent usage of child seats equipped with tethers.

The reason explained in the NPRM for proposing that tether straps not be attached during the 30 mph test was because of the overwhelming incorrect usage of child restraints with tethers by the public. However, the data available to the agency suggest that booster seats equipped with tethers are used correctly almost as often as child seats without tethers.

CHILD HARNESSES

The NPRM did not propose to change the current treatment for child harnesses in the Standard No. 213 testing. The surveys and data available to the agency have not examined the extent to which child harness tethers are misused by the public.

Moreover, NHTSA believes it would be obvious to users of child harnesses that the failure to attach the tether strap would leave the child completely unrestrained in a crash. The absence of data indicating misuse of child harness tether straps, together with the obvious need to attach these tether straps, resulted in the agency's position that the NPRM should not propose any changes to Standard No. 213 in this regard: that is, child harness would be permitted to have their tether straps attached during the 30 mph test and not be subject to the 20 mph test. No commenters addressed this area of the proposal, and the final rule does not make any changes to the current requirements for child harnesses for the reasons explained above.

CHILD RESTRAINTS FOR PHYSICALLY HANDICAPPED CHILDRES

A number of commenters urged the agency to exempt child restraints designed for handicapped children from the proposal that all child restraints, except child harnesses, pass the 30 mph test in Standard No. 213 without any tether strap attached. A manufacturer of child restraints for physically handicapped children commented: "Now that safe transportation for the handicapped child has become a reality, through the use of restraint harnesses, tether systems, and wheelchairs engineered to meet Standard No. 213, it seems counterproductive for the handicapped population and manufacturers to start over again."

NHTSA did not intend to require any changes to thes restraints, and a statement proposing the continuation of current testing requirements for restraints for physically handicapped children was inadvertently omitted from the NPRM. The agency during the 30 mph test and will not require these restraints to be subjected to the 20 mph test without test without the tether attached. NHTSA has no data showing that these restraints are frequently misused by the public. Additionally, there is no alternative at present to the use of tether straps to provide the necessary upper torso support for physically handicapped children. Hence, any requirement to eliminate the use of tether straps on restraints for physically handicapped children would lessen the protection available for those children. This was not the agency's intent in the NPRM.

OTHER ISSUES

The NPRM proposed that child restraints be installed at one of the two outboard seating positions on the standard seat during the testing. As explained above, this was proposed to ensure that the testing would be representative of the way in which child restraints would be used by the public. It was also proposed to enable child restraint manufacturers to reduce testing costs by evaluating two child restraint systems in a single test.

The commenters that addressed this proposed change generally opposed it. The University of Michigan commented that there was no basis for the concern expressed in the NPRM that testing in the center seating position might not be representative of the way in which child restraints are used by the public. The University stated: "We know from field experience that those restraints that meet the 30 mph test in the center seating position also effectively protect children in most crashes." Stated differently, child restraints that pass the 30 mph crash test in the center seating position have performed well when installed in the outboard seating positions of vehicles in use. The available data on the performance of child restraint systems indicate that the Standard No. 213 test procedures are representative of the conditions encountered by restraint systems when in use.

Further, one child restraint manufacturer and the University of Michigan stated that the agency's proposed change might increase testing costs, instead of achieving the agency's stated intent of reducing those costs. This could happen because child restraints would be subjected to slightly differing forces produced by asymmetrical lap belt anchorages at the outboard seating positions. Further, it was stated that all child restraints are not symmetrical, and their test performance might be affected by a twist in one direction, but not the other. These facts would mean that all existing models of child restraints would have to be retested to ensure that the restraints would pass the Standard No. 213 requirements when installed at the outboard seating positions. In addition, the child restraints would have to be tested at both the left and right outboard seating positions, because of the differenct forces presented at these different seating locations.

The proposed change to the required seating position for testing child restraints is not adopted in this final rule, because of the reasons set forth in the comments.

The NPRM also proposed that manufacturers be required to insert the phrase "For extra protection in frontal and side impacts" before the notice on the label that tether straps must be attached in accordance with the manufacturer's instructions.

This change was proposed in connection with the proposal to require all child restraints equipped with tethers to pass the 30 mph test without attaching the tethers. The change in the label language was intended to inform the public that the tether strap would offer supplementary safety protection when attached, but that it was not necessary to attach the tether for adequate protection.

BMW commented that the proposed change would have the unintended effect of implying that it was not necessary to use tether straps, and this implication would decrease the already low use of tether straps. The agency believes that the BMW comment has merit. The possibility of decreasing tether usage, combined with the fact that child harnesses, booster seats, and restraints for physically handicapped children may include tether straps, the attachment of which is necessary for adequate protection of the child, have led the agency to conclude that the proposed change to the label language should not be adopted in this final rule.

The other proposed changes were clarifications to the instructions which must accompany each child restraint. No commenters addressed these clarifications, and they are adopted for the reasons explained in the NPRM.

PART 571—[AMENDED]

In consideration of the foregoing, 49 CFR S571.213 is amended as follows:

1. The authority citation for Part 571 continues to read as follows:

AUTHORITY: 15 U.S.C. 1392, 1401,1403, 1407; delegation of authority at 49 CFR 1.50.

2. S4 is amended by adding the following definition immediately before the definition of "car bed":

S4. Definitions.

"Booster seat" means a child restraint which consist of only a seating platform that does not extend up to provide a cushion for the child's back or head.

* * * * *

3. S5.6.1 is revised to read as follows:

S5.6.1 The instructions shall state that, for maximum safety protection, child restraint systems should be installed in a rear seating position in vehicles with two rear seating positions and in the center rear seating position in vehicles with such a seating position.

4. S5.6.2 is revised to read as follows:

S5.6.2 The instructions shall specify in general terms the types of vehicles, the types of seating positions, and the types of vehicle safety belts with which the system can or cannot be used.

5. S6.1.2.1 is revised to read as follows:

S6.1.2.1 Test configuration.

S6.1.2.1.1 Test configuration I. In the case of each child restraint system other than a child harness, a booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children, install a new child restraint system at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6, except that the restraint shall be secured to the standard vehicle seat using only the standard vehicle lap belt. A child harness, booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children shall be installed at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6.

S6.1.2.1.2 Test configuration II. In the case of each child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, or a booster seat with a top anchorage strap, install a new child restraint system at the center seating position of the standard seat assembly using only the standard seat lap belt to secure the system to the standard seat.

Issued on February 10, 1986.

Diane K. Steed
Administrator

51 F.R. 5335
February 13, 1986

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems

[Docket No. 87-05; Notice 2]

ACTION: Final Rule.

SUMMARY: This document amends Federal Motor Vehicle Safety Standard No. 213, *Child Restraint Systems*, to permit installing built-in child restraint systems in passenger cars. The agency initiated this action in response to a petition for rulemaking submitted by Mr. Verne L. Freeland. As amended, Standard 213 sets performance requirements both for add-on child restraint systems, and for child restraint systems that form an integral part of a vehicle seat (built-in restraints).

DATE: This final rule is effective on January 22, 1988.

SUPPLEMENTARY INFORMATION: On March 23, 1987, NHTSA published a notice of proposed rulemaking (NPRM) in response to a petition from Mr. Verne L. Freeland. (52 FR 9194). Mr. Freeland asked that the agency amend Standard 213, *Child Restraint Systems*, to permit the production and installation of a child restraint system that forms an integral part of a vehicle seat (built-in child restraint system). Standard 213 was issued by the agency under the National Traffic and Motor Vehicle Safety Safety Act. (15 U.S.C. 1392 et seq.) When Mr. Freeland submitted his petition, the Standard set out performance requirements for a child restraint system that is placed on a vehicle seat and held in position by a vehicle lap belt (add-on child restraint system).

Because add-on child restraint systems were the only type of child restraint systems produced when the agency issued Standard 213 in 1970, the Standard addressed that kind of restraint, although some specifications would have been appropriate for built-in restraints. Recognizing that some Standard 213 provisions might apply either to built-in or add-on restraints, the agency proposed to amend the Standard only to the extent necessary to accommodate built-in restraints. In those instances where specifications would not accommodate built-in restraints, the agency proposed creating a separate requirement for each kind of restraint. NHTSA is adopting the amendments set out in the NPRM without change.

The agency received two comments on the proposed rule. A private citizen favored the amendment, stating that the convenience of a built-in child restraint might increase system use, and that instruction and labeling would facilitate appropriate use. The second commenter was Volvo Cars of North America (Volvo). Volvo generally favored the proposed amendment because the agency would be removing restrictions that inhibit innovation in child restraint systems design.

However, the company suggested that NHTSA delete the knee excursion requirement in subparagraph S5.1.3.1(b.) The knee excursion requirement exists to preclude a child restraint system design that controls unacceptable forward head movement under test conditions by allowing excessive forward and down movement of the lower body. When a test dummy slides excessively forward and down, legs first, under crash test conditions, the phenomenon is called "submarining."

The company gave two reasons for its suggestion that the agency delete the knee excursion requirement for built-in child restraint systems. The first was that because section S5.4.3.3 of the Standard requires a 5-point harness (including a crotch strap), the risk of submarining is minimal; therefore, the knee excursion requirement is unnecessary. The second reason is the difficulty in filming knee excursion during a crash test given that a manufacturer must test a built-in restraint in a complete vehicle or body shell. (One tests an add-on child restraint by securing it to a special test platform traveling at an equivalent vehicle speed of 30 miles per hour.) NHTSA rejects Volvo's suggestion for the following reasons.

The 5-Point Harness and Reduced Submarining Risk. First, contrary to Volvo's comment, S5.4.3.3 allows child restraint systems other than a 5-point harness system. Because those systems may not include a crotch strap, the risk of submarining is significant and the need for a knee excursion requirement is indisputable. However, Volvo correctly observes that the risk of submarining is "very small" for current child restraint systems that use a 5-point harness. On the other hand, a critical reason that the agency has a knee excursion

requirement is to discourage a manufacturer's permitting excessive knee excursion in order to achieve acceptable head excursion or injury limitations. NHTSA wishes to preclude this kind of trade-off in any type of restraint system, and therefore declines to eliminate the knee excursion requirement.

Difficulty in Filming Knee Excursion During a Crash Test. NHTSA finds this argument without merit. The technology of photographing events occurring in actual or simulated vehicle crashes is well developed. To record events inside a vehicle during a crash, it is common practice in both research and compliance testing to mount a camera facing inward either on a stationary bracket or on a bracket attached to the automobile or sled-structure. A built-in child restraint systems manufacturer can use a similar procedure to record knee excursion.

NHTSA recognizes that it may not be easy to combine the knee excursion test with other vehicle tests; therefore, installing a built-in restraint in a vehicle may add to development costs. On the other hand, the agency does not require that a manufacturer install such a system, and these added costs may be avoided simply through the manufacturer's election not to offer built-in restraints. A manufacturer which chooses to provide a built-in restraint system must be willing to make a reasonable assessment of the system's safety.

Conclusion. NHTSA concludes that built-in child restraint systems can provide a level of safety at least equal to that provided by add-on child restraint systems. Additionally, the agency notes that a built-in child restraint system may encourage system use because these systems will be available as an integral part of the vehicle.

Therefore, the agency adopts the change to Federal Motor Vehicle Safety Standard No. 213 set out in the NPRM published on March 23, 1983.

Effective Date. This rule will make manufacturing child restraint systems less restrictive by permitting production and installation of a new type of system. Further, the Standard as amended does not require a manufacturer to include the system in its product line, but rather expands manufacturer options. Because the rules relieves a restriction, there is good cause for making it effective immediately, i.e., on the publication date.

PART 571 [AMENDED]

In consideration of the foregoing, NHTSA amends Title 49, Part 571.213, *Child Restraint Systems,* as follows:

S4 of 49 CFR 571.213 is amended to include three new definitions as follows:

"Add-on child restraint system" means any portable child restrain system.

"Built-in child restraint system" means any child restraint system which is an integral part of a passenger car.

"Specific vehicle shell" means the actual vehicle model part into which the built-in child restraint system is fabricated, including the complete surroundings of the built-in system. If the built-in child restraint system is manufactured as part of the rear seat, these surroundings include the back of the front seat, the interior rear side door panels and trim, the rear seat, the floor pan, the B and C pillars, and the ceiling. If the built-in system is manufactured as part of the front seat, these surroundings include the dashboard; the steering wheel, column, and attached levers and knobs; the "A" pillars; any levers and knobs installed in the floor or on a console; the interior front side door panels and trim; the front seat; the floor pan; and the ceiling.

S5 of 49 CFR 571.213 is revised to read as follows:

S5 *Requirements for child restraint systems certified for use in motor vehicles.* Each child restraint system certified for use in motor vehicles shall meet requirements in this section when, as specified, tested in accordance with S6.1

S5.1.3.1 of 49 CFR 571.213 is revised to read as follows:

S5.1.3.1 *Child restraint systems other than rear-facing ones and car beds.* Each child restraint system, other than rear-facing child restraint systems or a car bed, shall retain the test dummy's torso within the system.

(a) In the case of an add-on child restraint system, no portion of the test dummy's head shall pass through a vertical transverse plane that is 32 inches forward of point z on the standard seat assembly, measured along the center SORL (as illustrated in Figure 1B), and neither knee pivot point shall pass through a vertical, transverse plane that is 36 inches forward of point z on the standard seat assembly, measured along the center SORL.

(b) In the case of a built-in child restraint system, neither knee pivot shall pass through a vertical, transverse plane that is 36 inches forward of the hinge point of the specific passenger car seat into which the system is built, measured along a horizontal line parallel to the vehicle's longitudinal center line and the center line of the passenger car seat.

S5.2.1.2 of 49 CFR 571.213 is revised to read as follows:

S5.2.1.2 A front-facing child restraint system is not required to comply with S5.2.1.1 if the target point on either side of the dummy's head is below a horizontal plane tangent to the top of—

(a) The standard seat assembly, in the case of an add-on child restraint system, when the dummy is positioned in the system and the system is installed on the assembly in accordance with S6.1.2.

(b) The passenger car seat, in the case of a built-in child restraint system, when the system is activated and the dummy is positioned in the system in accordance with S6.1.2.

S5.2.2.2 of 49 CFR 571.213 is revised to read as follows:

S5.2.2.2 Each forward-facing child restraint system shall have no fixed or movable surface—

(a) Directly forward of the dummy and intersected by a horizontal line—

(1) Parallel to the SORL, in the case of the add-on child restraint system, or

(2) Parallel to a vertical plane through the longitudinal center line of the passenger car seat, in the case of the built-in child restraint system, and

(b) Passing through any portion of the dummy, except for surfaces which restrain the dummy when the system is tested in accordance with S6.1.2.1.2, so that the child restraint system shall conform to the requirements of S5.1.2 and S5.1.3.1.

S5.3.1 and S5.3.2 of 49 CFR 571.213 is revised to read as follows:

S5.3.1 Each add-on child restraint system shall have no means designed for attaching the system to a vehicle seat cushion or vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back.

S5.3.2 When installed on a vehicle seat, each add-on child restraint system, other than child harnesses, shall be capable of being restrained against forward movement solely by means of a Type I seat belt assembly (defined in §571.209) that meets Standard No. 208 (§571.208), or by means of a Type I seat belt assembly plus one additional anchorage strap that is supplied with the system and conforms to S5.4.

S5.4.3.2 of 49 CFR 571.213 is revised to read as follows:

S5.4.3.2 *Direct restraint.* Each belt that is part of a child restraint system and that is designed to restrain a child using the system and to attach the system to the vehicle shall, when tested in accordance with S6.1, impose no loads on the child that result from the mass of the system, or

(a) in the case of an add-on child restraint system, from the mass of the seat back of the standard seat assembly specified in S7.3, or

(b) in the case of a built-in child restraint system, from the mass of any part of the vehicle into which the child restraint system is built.

S5.5.1 of 49 CFR 571.213 is revised to read as follows:

S5.5.1 Each add-on child restraint system shall be permanently labeled with the information specified in S5.5.2(a) through (1).

S5.5.3 of 49 CFR 571.213 is revised to read as follows:

S5.5.3 The information specified in S5.5.2(g) through (k) shall be located on the add-on child restraint system so that it is visible when the system is installed as specified in S5.6.1.

A new paragraph S5.5.4 is added to 49 CFR 571.213 to read as follows:

S5.5.4 Each built-in child restraint system shall be permanently labeled with the information specified in S5.5.5(a) through (j), so that it is visible when the system is activated for use as specified in S5.6.2.

A new paragraph S5.5.5 is added to 49 CFR 571.213 to read as follows:

S5.5.5 The information specified in paragraphs (a) through (j) of this section shall be stated in the English language and lettered in letters and numbers which are not smaller than 10-point type and are on a contrasting background. This information shall be printed in the vehicle owner's manual.

(a) The model name or number of the system.

(b) The manufacturer's name. A distributor's or dealer's name may be used instead if the distributor or dealer assumes responsibility for all duties and liabilities imposed on the manufacturer with respect to the system by the National Traffic and Motor Vehicle Safety Act, as amended.

(c) The statement: "Manufactured in ------," inserting the month and year of manufacture.

(d) The place of manufacture (city and State, or foreign country). However, if the manufacturer uses the name of the distributor or dealer, then it shall state the location (city and State, or foreign country) of the principal offices of the distributor or dealer.

(e) The statement: "This child restraint system conforms to all applicable Federal motor vehicle safety standards."

(f) One of the following statements, inserting the manufacturer's recommendations for the

maximum weight and height of children who can safely occupy the system:

(i) This infant restrain is designed for use by children who weigh ---- pounds or less and whose height is ---- inches or less;

(ii) This child restraint is designed for use only by children who weigh between ---- and ---- pounds and whose height is ---- inches or less and who are capable of sitting upright alone; or

(iii) This child restraint is designed for use by children who weigh between ---- and ---- pounds and are between ---- and ---- inches in height.

(g) The following statement:

WARNING! FAILURE TO FOLLOW THE MANUFACTURER'S INSTRUCTIONS ON THE USE OF THIS CHILD RESTRAINT SYSTEM CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH.

(h) In the case of each built-in child restraint system that has belts designed to restrain children using them:

SNUGLY ADJUST THE BELTS PROVIDED WITH THIS CHILD RESTRAINT AROUND YOUR CHILD.

(i) In the case of each built-in child restraint which can be used in a rear-facing position, the following statement:

PLACE AN INFANT IN A REAR-FACING POSITION IN THIS CHILD RESTRAINT.

(j) A diagram or diagrams showing the fully activated child restraint system in infant and/or child configurations.

S5.6 of 49 CFR 571.213 is revised to read as follows:

S5.6 *Printed Instructions for Proper Use.*

S5.6.1 *Add-on child restraint systems.* Each add-on child restraint system shall be accompanied by printed installation instructions in the English language that provide a step-by-step procedure, including diagrams, for installing the system in motor vehicles, securing the system in the vehicles, positioning a child in the system, and adjusting the system to fit the child.

S5.6.1.1 In a vehicle with rear designated seating positions, the instructions shall alert vehicle owners that, according to accident statistics, children are safer when properly restrained in the rear seating positions than in the front seating positions.

S5.6.1.2 The instructions shall specify in general terms the types of vehicles, the types of seating positions, and the types of vehicle safety belts with which the add-on child restraint system can or cannot be used.

S5.6.1.3 The instructions shall explain the primary consequences of not following the warnings required to be labeled on the child restraint system in accordance with S5.5.2 (g) through (k).

S5.6.1.4 The instructions for each car bed shall explain that the car bed should position in such a way that the child's head is near the center of the vehicle.

S5.6.1.5 The instructions shall state that add-on child restraint systems should be securely belted to the vehicle, even when they are not occupied, since in a crash an unsecured child restraint system may injure other occupants.

S5.6.1.6 Each add-on child restraint system shall have a location on the restraint for storing the manufacturer's instructions.

S5.6.2 *Built-in child restraint systems.* Each built-in child restraint system shall be accompanied by printed instructions in the English language that provide a step-by-step procedure, including diagrams, for activating the built-in child restraint system, positioning a child in the system, adjusting the restraint, and if provided, the restraint harness to fit the child. This information and the information specified in S5.5.5 shall be included in the vehicle owner's manual.

S5.6.2.1 The instructions shall explain the primary consequences of not following the manufacturer's warnings for proper use of the child restraint system in accordance with S5.5.5(f) through (i).

S5.7 of 49 CFR 571.213 is revised to read as follows:

S5.7 *Flammability.* Each material used in a child restraint system shall conform to the requirements of S4 of FMVSS No. 302 (571.302). In the case of a built-in child restraint system, the requirements of S4 of FMVSS No. 302 shall be met in both the "in-use" and "stowed" positions.

S6.1.1.1 of 49 CFR 571.213 is revised to read as follows:

S6.1.1.1(a) The test device for add-on child restraint systems is the standard seat assembly specified in S7.3. The assembly is mounted on a dynamic test platform so that the center SORL of the seat is parallel to the direction of the test platform travel and so that movement between the base of the assembly and the platform is prevented. The test device for built-in child restraint systems is either the specific vehicle shell or the specific vehicle. The specific vehicle shell, if selected for testing, is mounted on a dynamic test platform so that the longitudinal center line of the shell is parallel to the direction of the test platform travel and so that movement

between the base of the shell and the platform is prevented.

(b) The platform is instrumented with an accelerometer and data processing system having a frequency response of 60 Hz channel class as specified in Society of Automotive Engineers Recommended Practice J211 JUN80 "Instrumentation for Impact Tests." The accelerometer sensitive axis is parallel to the direction of test platform travel.

(c) For built-in child restraint systems, an alternate test device is the specific vehicle into which the built-in system is fabricated. Activate the system in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2. When the complete vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, the built-in child restraint system shall meet the injury criteria of S5.1.2. The following test conditions apply to this alternate test device.

(i) The vehicle is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the appropriate child test dummy and, at the option of the manufacturer, an anthropomorphic test dummy which conforms to the requirements of Subpart B or Subpart E of Part 572 of this title for a 50th percentile adult male dummy placed in the front outboard seating position. If the built-in child restraint system is installed at one of the seating positions otherwise requiring the placement of a Part 572 test dummy, then in the frontal barrier crash specified in S6.1.1.2, the appropriate child test dummy shall be substituted for the Part 572 test dummy, but only at that seating position. The fuel tank is filled to any level from 90 to 95 percent of capacity.

(ii) Adjustable seats are in the adjustment position midway between the forward most and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forward most and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

(iii) Adjustable seat backs are in the manufacturer's nominal design riding position. If a nominal position is not specified, the seat back is positioned so that the longitudinal center line of the child test dummy's neck is vertical, and if an anthropomorphic test dummy is used, the accelerometer surfaces in the test dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

(iv) Movable vehicle windows and vents are, at the manufacturer's option, placed in the fully closed position.

(v) Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.

(vi) Doors are fully closed and latched but not locked.

(vii) All instrumentation and data reduction is in conformance with SAE J211 JUN80.

S6.1.1.2 is revised to read as follows:

S6.1.1.2 The tests are frontal barrier impact simulations of the test platform or frontal barrier crashes of the specific vehicles as specified in S5.1 (571.208) and for:

(a) Test Configuration I specified in S6.1.2.1.1 are at a velocity change of 30 mph with the acceleration of the test platform entirely within the curve shown in Figure 2, or for the specific vehicle test with the deceleration produced in 30 mph frontal barrier crash.

(b) Test Configuration II specified in S6.1.2.1.2 are set at a velocity change of 20 mph with the acceleration of the test platform entirely within the curve shown in Figure 3, or for the specific vehicle test with the deceleration produced in 20 mph frontal barrier crash.

S6.1.1.3 of 49 CFR 571.213 is revised to read as follows:

S6.1.1.3 In the case of add-on child restraint systems, Type 1 seat belt assemblies meeting the requirements of Standard No. 209 (§571.209) and having webbing with a width of not more than 2 inches are attached, without the use of retractors or reels of any kind, to the seat belt anchorage points (illustrated in Figure 1B) provided on the standard seat assembly.

S6.1.2.1 of 49 CFR 571.213 is revised to read as follows:

S6.1.2.1 *Test Configuration.*

S6.1.2.1.1 *Test Configuration I.* (a) In the case of each add-on child restraint system other than a child harness, a booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children, install a new add-on child restraint system at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6.1, except that the add-on restraint shall be secured to the standard vehicle

seat using only the standard vehicle lap belt. A child harness, a booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children shall be installed at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6.1.

(b) In the case of each built-in child restraint system, activate the restraint in the specific vehicle shell or the specific vehicle, in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2.

S6.1.2.1.2 *Test Configuration II* (a) In the case of each add-on child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, or a booster seat with a top anchorage strap, install a new add-on child restraint system at the center seating position of the standard seat assembly using only the standard seat lap belt to secure the system to the standard seat.

(b) In the case of each built-in child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, or a built-in booster seat with a top anchorage strap, activate the system in the specific vehicle shell or the specific vehicle in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2.

S6.1.2.2 of 49 CFR 571.213 is revised to read as follows:

S6.1.2.2 Tighten all belts used to attach the add-on child restraint system to the standard seat assembly to a tension of not less than 12 pounds and not more than 15 pounds, as measured by a load cell used on the webbing portion of the belt. Tighten all manual vehicle belts used to secure the built-in child restraint system or a child to the specific vehicle shell or specific vehicle to one of the following tensions:

(a) For a seat equipped with a manual adjuster or automatic locking retractor, not less than 12 pounds and not more than 15 pounds, as measured by a load cell used on the webbing portion of the belt;

(b) For a seat equipped with an emergency locking retractor, as specified in S4.3 of Standard 209.

S6.1.2.3.1 of 49 CFR 571.213 is revised to read as follows:

S6.1.2.3.1 When placing the 3-year-old test dummy in add-on or built-in child restraint systems other than car beds, position the test dummy according to the instructions for child positioning provided by the manufacturer with the system in accordance with S5.6.1 or S5.6.2 while conforming to the following:

(a) Holding the test dummy torso upright until it contacts the system's design seating surface, place the test dummy in the seated position within the system with the midsagittal plane of the test dummy head—

(1) coincident with the center SORL of the standard seating assembly, in the case of the add-on child restraint system, or

(2) vertical and parallel to the longitudinal center line of the specific vehicle shell or the specific vehicle, in the case of a built-in child restraint system.

(b) Extend the arms of the test dummy as far as possible in the upward vertical direction. Extend the legs of the dummy as far as possible in the forward horizontal direction, with the dummy feet perpendicular to the centerline of the lower legs.

(c) Using a flat square surface with an area of 4 square inches, apply a force of 40 pounds, perpendicular to:

(i) the plane of the back of the standard seat assembly in the case of an add-on child restraint system, or

(ii) the back of the vehicle seat in the specific vehicle shell or the specific vehicle in the case of a built-in child restraint system, first against the dummy crotch and then at the dummy thorax in the midsagittal plane of the dummy. For a child restraint system with a fixed or movable surface described in S5.2.2.2, which is being tested under the conditions of Test Configuration II, do not attach any of the child restraint belts unless they are an integral part of the fixed or movable surface. For all other child restraint systems and for a child restraint system with a fixed or movable surface which is being tested under the conditions of Test Configuration I, attach all appropriate child restraint belts and tighten them as specified in S6.1.2.4. Attach all appropriate vehicle belts and tighten them as specified in S6.1.2.2. Position each movable surface in accordance with the manufacturer's instructions provided in accordance with S5.6.1 or S5.6.2.

(d) After the steps specified in paragraph (c) of this section, rotate each dummy limb downwards in the plane parallel to the dummy's midsagittal plane until the limb contacts a surface of the child restraint system or the standard seat assembly in the case of an add-on system, or the specific vehicle shell or specific vehicle in the case

of a built-in system, as appropriate. Position the limbs, if necessary, so that limb placement does not inhibit torso or head movement in tests conducted under S6.

S6.1.2.3.2 of 49 CFR 571.213 is revised to read as follows:

S6.1.2.3.2 When placing the 6-month-old dummy in add-on or built-in child restraint systems other than car beds, position the test dummy according to the instructions for child positioning provided with the system by the manufacturer in accordance with S5.6.1 or S5.6.2 while conforming to the following:

(a) With the dummy in the supine position on a horizontal surface, and while preventing movement of the dummy torso by placing a hand on the center of the torso, rotate the dummy legs upward by lifting the feet until the legs contact the upper torso and the feet touch the head, and then slowly release the legs but do not return them to the flat surface.

(b) Place the dummy in the child restraint system so that the back of the dummy torso contacts the back support surface of the system. For a child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, which is being tested under the conditions of Test Configuration II, do not attach any of the child restraint belts unless they are an integral part of the fixed or movable surface. For all other child restraint systems and for a child restraint system with a fixed or movable surface which is being tested under the conditions of Test Configuration I, attach all appropriate child restraint belts and tighten them as specified in S6.1.2.4. Attach all appropriate vehicle belts and tighten them as specified in S6.1.2.2. Position each movable surface in accordance with the manufacturer's instructions provided in accordance with S5.6.1 or S5.6.2. If the dummy's head does not remain in the proper position, it shall be taped against the front of the seat back surface of the system by means of a single thickness of 1/4-inch-wide paper masking tape placed across the center of the dummy face.

(c) Position the dummy arms vertically upwards and then rotate each arm downward toward the dummy's lower body until the arm contacts a surface, of the child restraint system or the standard seat assembly in the case of an add-on child restraint system, or the specific vehicle shell or the specific vehicle in the case of a built-in child restraint system, ensuring that no arm is restrained from movement in other than the downward direction, by any part of the system or the belts used to anchor the system to the standard seat assembly, the specific vehicle shell, or the specific vehicle.

S6.1.2.6 of 49 CFR 571.213 is revised to read as follows:

S6.1.2.6 For add-on child restraint systems, measure dummy excursion and determine conformance with the requirements specified in S5.1 as appropriate. For built-in child restraint systems, measure dummy knee excursion and determine conformance with the requirements specified in S5.1 as appropriate.

S6.2.3 of 49 CFR 571.213 is revised to read as follows:

S6.2.3 Pull the sling horizontally in the manner illustrated in Figure 4 and parallel to the center SORL of the standard seat assembly, in the case of an add-on child restraint system, or parallel to the longitudinal center line of either the specific vehicle shell or the specific vehicle, in the case of a built-in child restraint system, and apply a force of 20 pounds in the case of a system tested with a 6-month-old dummy and 45 pounds in the case of a system tested with a 3-year-old dummy.

S7.3 of 49 CFR 571.213 is revised to read as follows:

S7.3 *Standard test devices.*

(a) The standard test devices used in testing add-on child restraint systems under this standard are:

(1) For testing for motor vehicle use, a standard seat assembly consisting of a simulated vehicle bench seat, with three seating positions, which is described in Drawing Package SAS-100-1000 (consisting of drawings and a bill of materials); and

(2) For testing for aircraft use, a standard seat assembly consisting of a representative aircraft passenger seat.

(b) The standard test devices used in testing built-in child restraint systems under this standard are either a specific vehicle shell or a specific vehicle.

Issued on January 15, 1988

Diane K, Steed
Administrator

53 F.R. 1783
January 22, 1988

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213 and PART 572

Anthropomorphic Test Dummies—3-Year-Old Child (Docket No. 89-13; Notice 2) RIN 2127-AB94

ACTION: Final rule.

SUMMARY: This notice amends NHTSA's specifications for the 3-year-old-child test dummy NHTSA uses to test child restraint systems. Specifications are provided for a new head which has a higher natural frequency response, and is therefore better suited for compliance testing than the present head assembly. In addition, generic specifications are set for two different types of accelerometers which may be used with the dummy.

DATES: The effective date for making these amendments to the CFR is August 27, 1990.

Until September 1, 1993, each 3-year-old-child test dummy NHTSA uses to test an add-on child restraint will incorporate, at the manufacturer's option, either the new head assembly specified in §572.16(a)(1) or the old head assembly specified in §572.16(a)(2).

Effective September 1, 1993, each 3-year-old-child dummy NHTSA uses to test an add-on child restraint will incorporate the new head assembly specified in §572.16(a)(1).

Beginning August 27, 1990, each 3-year-old-child dummy NHTSA uses to test a built-in child restraint incorporates the new head assembly specified in §572.16(a)(1).

SUPPLEMENTARY INFORMATION:

Background. On July 11, 1989, NHTSA published a notice of proposed rulemaking (NPRM) concerning changes to the agency's specifications for the 3-year-old-child test dummy (54 FR 29071).

First, the agency proposed a new head assembly for the test dummy. The agency also proposed that, if the new specifications were adopted, dummies conforming to them would be used by the agency when evaluating both add-on and built-in restraints. (A built-in child restraint is one that is an integral part of a vehicle.)

This proposal was developed following the implementation on January 22, 1988 of amendments to Standard No. 213 establishing performance and test criteria expressly applicable to built-in restraint systems. Prior to that date, Standard 213 specified performance and test criteria suitable for add-on child restraint systems only. (An add-on restraint is any portable child restraint system.) In tests of add-on systems, the test environment is a standard vehicle seat assembly to which the restraint is attached by a lap belt. During testing, the dummy's head does not contact a rigid surface which is not part of the child restraint system.

During compliance testing of built-in restraint systems, the dummy's head may contact a rigid surface, because the performance of the built-in restraint in protecting the child is determined by testing the restraint in proximity to other parts of the vehicle interior, which may include rigid surfaces. The current head of the 3-year-old-child dummy has a relatively low natural frequency response, which may cause it to give unreliable data when the head contacts a rigid surface. The agency believed there was an apparent need to adopt a head that has a natural frequency response (the frequency of a free vibration at which an elastic system starts to vibrate when impacted by a force) appropriate for measuring acceleration resulting from impact between the dummy head and rigid surfaces. (Issues relating to the reliability and validity of the new head as a test device were thoroughly discussed in the NPRM and will not be repeated here.)

Second, the agency proposed two different types of generically designated accelerometers based on frequency response characteristics and location specifications within the dummy. Any accelerometer system conforming with these specifications could be used with the dummy. NHTSA proposed the generic accelerometer specifications because manufacture of the particular accelerometer model specified in Part 572 has been discontinued, and because NHTSA tentatively concluded there was no necessity to specify another particular model for use in compliance testing. Any accelerometer that meets the proposed specifications, and is positioned in the test dummy at the specified reference points so that the seismic masses of each sensing element would be

aligned with the head and thoracic reference points, would give the same measurements as any other accelerometer with the equivalent impact response characteristics and positioning. NHTSA believed that generic accelerometer specifications would avoid difficulties associated with a particular accelerometer model when the manufacture of that model is discontinued.

Comments on the NPRM

New head design

NHTSA received six comments on the proposed changes. The University of Michigan (UM) strongly urged that the agency adopt the new head. The University said that UM has been using the new head in child restraint tests since the early 1980's, and because of the existing head's low natural frequency, would not consider returning to the use of the old design. Volvo Cars of North America also supported the proposed change to the new head, stating that "the change of material in the dummy head will avoid some of the interfering noise occurring in the old dummy head due to its low material frequency."

General Motors Corporation (GM) submitted initial and supplemental comments on the NPRM. In its initial comment, GM said it had yet to test the proposed dummy head, but expressed concern that "the 3-year-old-child dummy, with or without the new head, still lacks a reasonable level of impact response biofidelity." (GM's comment reflects the fact that, after NHTSA established specifications for the 3-year-old-child test dummy in 1979, GM petitioned the agency to reconsider whether the specified dummy was an appropriate test device. NHTSA analyzed GM's concerns about the dummy and found them to be without merit. Accordingly, the agency denied the petition (45 FR 82265; December 15, 1980).) GM did not provide any data or information in its initial comment to the NPRM that convincingly established that NHTSA should refrain from using the 3-year-old-child test dummy to test child restraint systems. In its supplemental comment, GM stated that it tested the proposed head assembly and found that head accelerations met the proposed calibration levels when a light coat of a silicone lubricant was applied between the head skin and skull prior to the test. Applying a lubricant is recognized by the Society of Automotive Engineers (SAE) as an acceptable practice and is used by the industry to bring other Part 572 test dummies into calibration specifications. GM stated that it agreed with the proposed specification and use of the new head assembly on the 3-year-old-child test dummy.

Ford supported the agency's objective of improving the testing capability of the 3-year-old-child dummy, but was concerned that the natural frequency of the proposed fiberglass head "still may have too low a natural frequency to eliminate ringing." Ford seemed to believe that the new head has a natural frequency "just above 1000 Hz," which would cause mechanical ringing of the head at or near that frequency in certain impacts. The commenter suggested that NHTSA consider developing a new dummy head with a structure of aluminum or magnesium, "to provide a natural frequency well above 1000 Hz."

Ford apparently was not aware that the natural frequency of the new head is 3,300 Hz, which is 3.3 times higher than the nominal class 1,000 filter cut-off frequency referenced in §572.21 and specified by the SAE for head impact response measurements ("Performance Measurements of Three-Year-Old-Child Test Dummy Heads, December 1983; Report No. DOT HS 806–742). That natural frequency is considerably higher than that of the current head (400 Hz). Because the adequacy of the new head has been established by NHTSA testing, and because no information has arisen showing problems with the new head, the agency believes the new dummy head is completely suitable for use in the 3-year-old child dummy.

The NPRM proposed that NHTSA would continue testing add-on restraints with the present dummy head or the new head, at the manufacturer's option, for 3 years. The NPRM proposed that, after the 3-year period, NHTSA would test all add-on child restraints with dummies incorporating the new head assembly. The agency explained in the NPRM that it sought to have, eventually, only one head assembly for the 3-year-old-child dummy, to preclude inadvertent use of the current head assembly in a compliance test of a built-in restraint.

Ford requested that the agency permit indefinite use of the present dummy head, rather than limit such use to a 3-year period. Ford said that there is little risk that the wrong head would be mistakenly used, particularly if the new head is composed of aluminum or magnesium, materials unlike in appearance to the current (urethane) dummy head.

NHTSA disagrees with Ford that the agency's compliance procedures should permit the indefinite use of the present dummy head. Since the new head will be composed from fiberglass (and not the aluminum and magnesium materials Ford suggested) and is outwardly identical to the current head assembly, it is important that the agency reduce the likelihood that the present head could be inadvertently used in a compliance test of a built-in restraint system. Such errors would represent a needless waste of time and resources. With respect to add-on restraints, those that pass a Standard 213 compliance test when tested with a dummy incorporating the existing

head should also pass when tested with a dummy using the new head. Thus, there is no apparent advantage to retaining the old head beyond the 3-year period. Further, test dummy heads, on average, must be replaced after approximately 3 years due to the wear from testing and the aging of the rubbers and plastics in the head. Thus, the 3-year transition period before use of the new head assembly is mandated should not impose any burdens on the dummy users. Testing facilities could continue using the current head assemblies during the 3-year transition period and could purchase the new head assemblies when the current head assemblies must be replaced.

Ford and GM highlighted sections of the proposed regulatory language where typographical or editorial corrections were appropriate. NHTSA has adopted these suggestions. In addition, Ford asked the agency to make it clear that, during the 3-year period when optional use of either head is permitted, NHTSA's compliance testing would be conducted using the type of dummy head that the add-on child restraint manufacturer chose to use in certifying its restraint system. NHTSA does not object to using the same type of head, and has revised the text of S7.2 of Standard 213 to specify that the type of head used in compliance tests during the 3-year period is at the manufacturer's option.

Proposed specifications for the accelerometer

All comments relating to the proposed adoption of generic specifications for the accelerometer were supportive of the proposal. Ford suggested minor changes to the regulatory language to clarify specifications or correct typographical errors. The agency agrees with these recommendations, and has adopted the generic specifications proposed in the NPRM, as revised by Ford's suggested changes.

Effective date

The effective date for making these amendments to the CFR is 30 days from the date of publication.

Beginning 30 days after publication of the final rule, each 3-year-old-child test dummy NHTSA uses to test a built-in child restraint will be assembled with the new head assembly specified in §572.16(a)(1). The higher natural frequency response of the new head assembly will ensure that the head acceleration measurements taken during testing of built-in child restraints are accurate and reliable. Because of the need for accurate and reliable head acceleration measurements, the agency finds that this effective date of less than 180 days is in the public interest.

For add-on restraints, the NPRM proposed that manufacturers would have the option of specifying the use of the current or new head assembly in NHTSA compliance testing, beginning 30 days after publication of the final rule, "until three years after publication of a final rule." Permitting optional use of the proposed head assembly beginning 30 days after publication will not impose any burdens on any party, and will further the public interest by allowing manufacturers to gain experience with the new head assembly. Thus, NHTSA again finds good cause for such an effective date.

Although the NPRM did not identify the exact date 3 years after publication of a final rule from which use of the present head assembly in NHTSA's compliance tests will cease, such a date must be specified in Standard 213 so that all persons reading the standard can readily know how NHTSA conducts its testing. This final rule specifies this date as September 1, 1993. The agency has determined that this date is appropriate because it is approximately 3 years after the date of anticipated issuance of this final rule, and consistent with the date the NPRM proposed.

In consideration of the foregoing, NHTSA amends 49 CFR Parts 571 and 572 as follows:

S7.2 of §571.213 is revised to read as follows:

S7.2 *Three-year-old-child dummy.* A three-year-old-child dummy conforming to Subpart C of Part 572 of this chapter is used for testing a child restraint that is recommended by its manufacturer in accordance with S5.6 for use by children in a weight range that includes children weighing more than 20 pounds.

(a) *Built-in child restraints.* When a three-year-old-child test dummy is used for testing a built-in child restraint, the dummy shall be assembled with the head assembly specified in §572.16(a)(1).

(b) *Add-on child restraints.* Until September 1, 1993, when a three-year-old-child test dummy is used for testing an add-on child restraint, the dummy shall be assembled using, at the manufacturer's option, either head assembly specified in §572.16(a).

Effective September 1, 1993, when a three-year-old-child dummy is used for testing an add-on child restraint, the dummy shall be assembled with the head assembly specified in §572.16(a)(1).

* * * * *

PART 572—ANTHROPOMORPHIC TEST DUMMIES

1. The authority citation for Part 572 continues to read as follows:

Authority: 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.50.

Subpart C—3-Year-Old Child

2. Paragraphs (a) and (b) of section 572.16 are revised to read as follows:

§572.16 Head.

(a) The head consists of the assembly designated

as SA 103C 010 on drawing no. SA 103C 001, and conforms to either—

(1) each item specified on drawing SA 103C 002(B), sheet 8; or

(2) each item specified on drawing SA 103C 002, sheet 8.

(b) When the head is impacted by a test probe specified in §572.21(a)(1) at 7 fps, then the peak resultant acceleration measured at the location of the accelerometer mounted in the headform according to §572.21(b) is not less than 95g and not more than 118g.

(1) The recorded acceleration-time curve for this test is unimodal at or above the 50g level, and lies at or above that level for intervals:

(i) in the case of the head assembly specified in paragraph (a)(1) of this section, not less than 1.3 milliseconds and not more than 2.0 milliseconds;

(ii) in the case of the head assembly specified in paragraph (a)(2) of this section, not less than 2.0 milliseconds and not more than 3.0 milliseconds.

(2) The lateral acceleration vector does not exceed 7g.

* * * * *

Section 572.17(a) is revised to read as follows:

§572.17 Neck.

(a)(1) The neck for use with the head assembly described in §572.16(a)(1) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002(B), sheet 9.

(2) The neck for use with the head assembly described in §572.16(a)(2) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002, sheet 9.

* * * * *

Section 572.21 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§572.21 Test conditions and instrumentation.

(a)(1) The test probe used for head and thoracic impact tests is a cylinder 3 inches in diameter, 13.8 inches long, and weighing 10 lbs., 6 ozs. Its impacting end has a flat right face that is rigid and that has an edge radius of 0.5 inches.

(2) The head and thorax assembly may be instrumented with a Type A or Type C accelerometer.

(i) Type A accelerometer is defined in drawing SA–572 S1.

(ii) Type C accelerometer is defined in drawing SA–572 S2.

(b) *Head Accelerometers.* Install one of the triaxial accelerometers specified in §572.21(a)(2) on a mounting block located on the horizontal transverse bulkhead as shown in the drawings subreferenced under assembly SA 103C 010 so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the head accelerometer reference point located at the intersection of a line connecting the longitudinal centerlines of the transfer pins in the side of the dummy head with the midsagittal plane of the dummy head.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with the midsagittal plane, with the seismic mass center located 0.2 inches dorsal to, and 0.1 inches inferior to the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane, perpendicular to the midsagittal plane, with the seismic mass center located 0.1 inches inferior, 0.4 inches to the right of, and 0.9 inches dorsal to the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 inches inferior to, 0.6 inches dorsal to, and 0.4 inches to the right of the head accelerometer reference point.

(iv) All seismic mass centers are positioned with ±0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with midsagittal planes, with the seismic mass center located from 0.2 to 0.47 inches dorsal to, from 0.01 inches inferior to 0.21 inches superior, and from 0.0 to 0.17 inches left of the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane, perpendicular to the midsagittal plane, with the seismic mass center located 0.1 to 0.13 inches inferior to, 0.17 to 0.4 inches to the right of, and 0.47 to 0.9 inches dorsal of the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 to 0.13 inches inferior to, 0.6 to 0.81 inches dorsal to, and from 0.17 inches left to 0.4 inches right of the head accelerometer reference point.

(c) *Thorax Accelerometers.* Install one of the triaxial accelerometers specified in §572.21(a)(2) on a mounting plate attached to the vertical transverse bulkhead shown in the drawing subreferenced under assembly No. SA 103C 030 in drawing SA 103C 001, so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the thorax accelerometer reference

point located in the midsagittal plane 3 inches above the top surface of the lumbar spine, and 0.3 inches dorsal to the accelerometer mounting plate surface.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with the seismic mass center located 0.2 inches to the left of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane, and perpendicular to the midsagittal plane, with the seismic mass center located 0.2 inches to the right of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.2 inches superior to, 0.5 inches to the right of, and 0.1 inches ventral to the thorax accelerometer reference points.

(iv) All seismic mass centers shall be positioned within ± 0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with the seismic mass center located from 0.2 inches left to 0.28 inches right, from 0.5 to 0.15 inches inferior to, and from 0.15 to 0.25 inches ventral of the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane and perpendicular to the midsagittal plane, with the seismic mass center located from 0.06 inches left to 0.2 inches right of, from 0.1 inches inferior to 0.24 inches superior, and 0.15 to 0.25 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.15 to 0.25 inches superior to, 0.28 to 0.5 inches to the right of, and from 0.1 inches ventral to 0.19 inches dorsal to the thorax accelerometer reference point.

Issued on July 20, 1990.

Jerry Ralph Curry
Administrator

55 FR 30465
July 26, 1990

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213
Child Restraint Systems

(Docket No. 74-09; Notice 26)
RIN: 2127-AD46

ACTION: Final rule.

SUMMARY: This rule amends Standard 213, Child Restraint Systems, to require manufacturers of child restraints to provide a postage paid registration form with each seat. The rule also amends the standard to require manufacturers to provide information to purchasers about the importance of registering the restraint, as well as information necessary to enable subsequent owners to register the restraint. In addition to amending Standard 213, this rule adds a new Part 588 in title 49, CFR, that requires manufacturers to keep records of the names and addresses of persons who have returned a registration form.

These requirements will improve the effectiveness of manufacturer campaigns to recall child restraints that contain a safety-related defect or fail to conform to Standard 213 by requiring manufacturers to take steps that will increase their ability to inform owners of particular child restraints about defects or noncompliances in those restraints and by encouraging child restraint owners to register their restraints. The requirements will also assist NHTSA in determining whether a child safety seat manufacturer has complied with its notification responsibilities established by the National Traffic and Motor Vehicle Safety Act.

This rulemaking proceeding commenced in response to a December 1989 petition for rulemaking from the Center for Auto Safety and Consumer Action of San Francisco.

EFFECTIVE DATE: The amendment is effective March 9, 1993.

SUPPLEMENTARY INFORMATION:

General introduction

This rule amends Standard 213 to establish a registration program for child restraint systems. The rule requires manufacturers to provide a standardized, postage-paid registration form with each restraint system. Manufacturers of built-in restraints installed in new vehicles are excluded from the requirement because the manufacturers are able to identify the vehicle owners through motor vehicle registration files and directly notify them of a recall concerning the built-in restraints.

The rule standardizes the text and layout of the registration form to increase the likelihood that a purchaser will register the restraint. On each form, manufacturers must preprint their return address, along with information identifying the model name or number of the restraint to which the form is attached. The form must be attached to the restraint to ensure that a purchaser will notice the form.

This rule also requires manufacturers to keep records of the names and addresses of persons who have returned a registration form. The manufacturers must maintain the record for at least six years from the date of manufacture of the seat.

NHTSA proposed the registration program in a notice of proposed rulemaking (NPRM) published on February 19, 1991 (56 FR 6603). Today's rule differs from the NPRM in various respects. The registration form is simplified. The labeling on the restraint must include both an address and a telephone number for the manufacturer. Cost estimates are slightly higher. The recordkeeping requirement of six years from the restraint's date of manufacture is two years less than was proposed. These and other changes are discussed further below.

This rule is intended to improve the percentage of recalled restraints that are fixed in a recall campaign for a noncompliance or defect. During 1981-1991, almost 18 million child restraints were recalled. During this period, about 13 percent of the child restraints involved in completed recall campaigns were reported as "campaigned units."

Campaigned units refer to those child restraints that were reported remedied as well as those restraints either removed from sale to the public or removed from use by the public. (During 1981-1989, approximately 6 million restraints were recalled. About 10.5 percent of the restraints involved in completed recall campaigns were reported as campaigned units during this period. During 1990-1991, almost 12 million child restraints were recalled. Only about 11 percent of the restraints involved in completed recall campaigns were reported as campaigned during this period.) In general, this indicates that the child restraint campaign rate is considerably lower than the campaign rate for motor vehicles (60.5 percent for 1981-1991).

(At the time of the NPRM, the child restraint average campaign completion rate was 22 percent. That rate reflected the number of seats that had been campaigned at the time of the NPRM. During the period 1990-1991, the average campaign completion rate increased to about 27 percent.) It should be noted that, even though the average campaign completion rate averaged about 27 percent during 1990-1991, for all campaigns in aggregate only about 11 percent of the restraints involved in completed recall campaigns were reported as campaigned.

The low response rate for child restraints does not seem a consequence of a lack of interest in recalls on the part of the owners. The public responded overwhelmingly to a December 1989 press conference by CAS on child seat recalls by calling NHTSA. In the eight months following that press conference, NHTSA's Auto Safety Hotline received over 30,000 calls from concerned parents asking about recalls and the safety of child seats. This intense interest in child safety indicates that many owners are highly motivated and would return a recalled seat for a remedy, if they knew it had been recalled. Stated differently, many owners might not have had the problem remedied because notification of the recall failed to reach them.

NHTSA proposed the registration program to improve the dissemination of the recall information directly to individual owners. In the past, efforts to improve notice of a recall focused on better disseminating the information indirectly, i.e., to the general public. The agency decided to change its focus to individual owners. If owners are directly notified that their seat is recalled, the response rate should increase.

Pursuant to a contract with the agency, National Analysts conducted a study of consumers' attitudes about the proposed registration program and other child safety issues during the time that the agency was developinq the NPRM. A copy of the February 1991 report has been available in the docket. The researchers conducted four group interviews ("focus groups"). Two groups were interviewed in Orange, California and the other two in Philadelphia, Pennsylvania. The groups were comprised of people who acquired a child restraint new and who use the restraint with their child at least once a week. The participants were asked to evaluate five different registration forms, three of which corresponded exactly to the NPRM's alternative Figure 9a, options one through three. The alternatives differed in how they presented a motivational message for the registration form.

National Analysts reported that participants in all four groups were unanimous in their support for a registration program. National Analysts concluded that, based on the findings from the study, "the great majority of child safety seat buyers are likely to appreciate and respond to a recall registration program." The researchers reported that:

> Participants also indicated that they would be most likely to return a pre-addressed, postage-prepaid card with an uncluttered graphic design that clearly and succinctly communicates the benefits of recall registration, differentiates itself from a warranty registration card, and requires minimal time and effort on the participant's part. "Child Safety Seat Registration: The Consumer View," National Analysts, February 1991.

Comments on the proposal

The agency received 22 comments on the NPRM, from manufacturers, researchers, church and consumer groups, state governments and private individuals. The overwhelming majority of the commenters supported a registration program. With the exceptions discussed below, the comments generally consisted of specific suggestions regarding the format and language of the form, the labeling on the restraint, and the recordkeeping part of the rule. Evenflo, Cosco and Chrysler Corporation (a manufacturer of built-in systems) expressed concerns about the effectiveness of registration programs. Evenflo and Cosco

also had cost concerns, which will be discussed in the section on "Costs."

Evenflo believed that a registration program would not be effective. Evenflo indicated that a registration program for child restraints can be compared to the "mandatory" registration requirements that Congress in 1982 specifically provided that the agency could not apply to independent tire dealers. *See,* 158(b) of the National Traffic and Motor Vehicle Safety Act of 1966. The mandatory registration program had required all tire dealers, including independent dealers, to obtain and send specified information (i.e., the purchaser's name and address, the dealer's name and address, and the identification numbers of the tires) to the tire manufacturer. ("Independent tire dealers" means tire dealers and distributors whose businesses are not owned or controlled by a tire manufacturer or brand name owner.)

Compliance with the mandatory registration was uneven. While virtually all tires on new vehicles were registered, about half of all replacement tires were registered. Independent dealers had registered only 20 percent of the requirement tires they sold.

With the goals of improving cne registration rate for tires sold by independent dealers and lessening the burden on the dealers, Congress prohibited NHTSA from requiring those dealers to comply with the mandatory registration program. In place of the mandatory program for the dealers, Congress directed NHTSA to establish a voluntary tire registration process. In the voluntary process, which is in effect today, the independent tire dealer furnishes a standardized registration form to each purchaser after the dealer has first filled in the tire identification number on the form. Purchasers wishing to register their tire fill in their name and address on the form and mail the completed form to the tire manufacturer. The form's postage is paid by the purchaser. The registration rate for the voluntary tire registration program is about 11 percent.

In response to Evenflo, NHTSA disagrees that the proposed registration process for child restraints is comparable to the mandatory program that had applied to independent tire dealers. In contrast, the proposed child restraint program has some similarities to the voluntary tire registration program that Congress directed NHTSA to adopt for the independent dealers. They are similar because in both cases, the semi-completed registration form is provided to the purchaser. Persons wishing to register their product may then do so by filling in their name and address and mailing the completed form to the restraint manufacturer.

However, even though similarities would exist between the two programs, NHTSA does not believe that the voluntary tire program is a good surrogate for what might happen in the child restraint program. First, in the child registration program: (a) every child restraint will be provided with a registration form attached to it; and (b) every registration form will describe to purchasers why the form should be filled and returned to the child restraint manufacturer. As previously mentioned, even though registration rates for independent tire dealers was about 11 percent, a consumer survey indicated that only 22 percent of these dealers' customers had received registration forms from their dealers, and that over 80 percent of the independent dealers' customers did not remember the dealer explaining the reasons why the registration form should be returned to the manufacturer. Second, consumers seem to be far more likely to be concerned with child safety than with tires, and therefore, they are more apt to fill in a registration form on child restraints than on tires. Third, the child restraint registration form is postage paid, a feature that the National Analysts study showed should have a positive effect on registration rates. Other information also shows the positive effect of providing the postage. According to information from the Consumer Product Safety Commission, warranty cards are returned for chain saws at a rate of 20 to 30 percent without postage paid; 40 percent with postage paid. Because of these differences, NHTSA does not believe the voluntary tire registration program is a good surrogate for what might happen in the child registration program.

Several commenters said that the registration process would be more effective if it involved more the retailer who sells the restraint to the purchaser. The CAS suggested that the process should "require consumers to register the child restraint at time of purchase and as a condition of the sale." The Coalition for Consumer Health and Safety said that the registration form should be "returned to the retailer at the point of sale, instead of enclosed with the seat to be mailed in by the consumer." Advocates for Highway and

Auto Safety also believed that the form should be completed by the consumer with the assistance of the retailer at the time of purchase.

The NPRM explained why the agency did not propose a seller registration process. The preamble stated:

In deciding whether to propose mandating registration by sellers or a lesser alternative, the agency was mindful that the Vehicle Safety Act does not provide NHTSA with explicit authority to require mandatory registration of child safety seats—i.e., to require sellers to register all seat purchases. Because of these concerns, and because child safety seats are sold to the public through a complex distribution system involving the manufacturer, major warehouse distributors, local distributors, and a wide variety of retail outlets, NHTSA concluded that a registration program for seats would have a greater likelihood of success in actual practice if the responsibility for registering were placed primarily on the manufacturer (to provide the card and registration information) and the first owner (to fill out the card and mail it). 56 FR at 6604.

NHTSA continues to believe that mandatory registration would be undesirable for the reasons stated in the NPRM. Further, a comparison can be made to the tire registration program. Congress found mandatory tire registration to be overly burdensome for independent businesses. The manufacture, distribution and sale of child seats is accomplished through a complex distribution system involving numerous retail outlets, large and small. A mandatory registration program could impose substantial burdens on these retailers.

Chrysler expressed concerns about the need for registration. Chrysler stated, "we do question the need for and value of the proposed registration requirements, given that the agency's estimate for card return rate is about 20 to 40 percent, and no estimate is offered for the probable recall response rate." Chrysler also stated that, because the card return rate might be no higher than 20 to 40 percent, "the manufacturer should be allowed the flexibility to determine for each instance how owners are to be notified, taking into account the nature of the particular defect or cause of noncompliance." The agency does not have information that would indicate the potential reduction in injuries or fatalities resulting from a registration requirement. The NPRM requested comments about instances where a child was injured in a safety seat that had been recalled by the manufacturer, but not fixed before the accident. No information was provided. Nevertheless, the agency believes there is a need for registration, to improve the notice end of a recall campaign. Today's registration requirements standardize the form to increase the likelihood that the purchaser will register. Today's requirements will increase the likelihood that the registrant will hear of a recall and realize that the recall pertains to the seat. These requirements address the problems referred to by Safety Belt Safe U.S.A. in its comment: "the vast majority of safety seat owners either do not learn of the recall/repair message; or...do not realize that publicized recall campaigns apply to them." These problems may have kept the recall response rate low.

Several factors might work to optimize the registration rate for the child restraint program. First of all, the public concern for child safety should have a decidedly positive effect on the return rate. Also, the child restraint registration form is conspicuous to the purchaser and is postage paid, features that should have a positive effect on registration rates.

With regard to flexibility, Chrysler implied that the registration program would obviate the need for public notice of a recall. NHTSA disagrees. Section 153(c)(3) of the Safety Act authorizes NHTSA to require the notification to be provided to known purchasers of the child restraint and to the general public. The agency anticipates that it would be appropriate to require public notice of the recall, in addition to direct notification of registrants, to ensure that notice is provided to the extent possible to owners who did not register, or to those whose address on registration records is not current or complete.

Cosco also had concerns about the program's effectiveness. Cosco said that the effectiveness of registration is lessened because "a significant number of restraints are passed down from family to family, sold in garage sales, etc."

NHTSA proposed the registration program keeping in mind that child restraints are frequently acquired "secondhand," as Cosco stated. To address that situation, the agency proposed labeling requirements to inform secondhand owners how to register with the manufacturer. When the secondhand owners have registered, they can be directly notified by the manufacturer if the

restraint is recalled. Thus, the purpose of the registration program would be fulfilled for second-hand owners through the labeling provisions.

The wording of the exclusion of built-in restraints has been slightly changed from the proposal. The proposal excluded "a built-in child restraint system installed in a vehicle by the vehicle manufacturer." The rule excludes a "factory-installed built-in child restraint system" from the registration requirements, and defines the term in S4 of Standard 213 as "a built-in child restraint system that was installed in a motor vehicle at the time of its delivery to a dealer or distributor for distribution." The change from the NPRM is intended only to simplify the wording of the requirements portion of the standard.

1. Standardized Reqistration Form.

The NPRM proposed requirements to increase the likelihood that the purchaser will notice the form, fill it in and mail it.

Attached form. The NPRM proposed that the form be attached to a "contactable surface" (the term is defined in S4) of the restraint so that the purchaser must, as a practical matter, notice and handle the form after purchasing the restraint and before putting it into use.

Several commenters addressed the proposal that the form be attached to a contactable surface. Evenflo said that "the location of the forms within the packaging or upon the product does not increase the likelihood of registration. Rather, it turns on the education of the consumer, their spare time and their ready access to the U.S. mail." In contrast, Safety Belt Safe said having the form be attached so that the purchaser must actively detach it will make it less likely that the form will be lost.

National Analysts found that respondents in the focus group study indicated that seeing and handling the card are important to maximize registration rates:

> There is also strong support for the registration card's being attached to the seat in such a way that it cannot be used without first removing the card. It is thought particularly important for the card to be packaged separately from instructions, warranties and other material enclosed with the CSS [child safety seat]. Suggestions include directly attaching the card to the seat liner—although some question whether an adhesive tacky enough to securely attach to the seat would not leave the seat sticky—or attaching it by means of a plastic tie, similar to those used to attach price tags to clothes in department stores.
>
> *"Make it so you can't rip it off but have to use scissors because then you'll read it."*
>
> [Participant's quotation emphasized in text.] (Id. at 29)

This rule adopts the requirement that the form must be attached to the child restraint. The National Analysts study indicates that the requirement will improve the likelihood that the form will be noticed and read by the purchaser. However, the rule permits the form to be attached to more surfaces than had been proposed. Under the NPRM, the only permissible surfaces were "contactable surfaces," i.e., surfaces contactable by a dummy's head or torso during a compliance test. Under the final rule, the form may be attached to any surface of the restraint that contacts any portion of the dummy when the dummy is positioned in the system in accordance with S6.1.2 of Standard 213. This change from the NPRM is made to allow more flexibility in selectinq a location for attaching the form.

Under a contactable surfaces requirement, the form would have had to be attached to surfaces only contactable by a dummy's head or torso, since "contactable surface" in S4 is limited to head and torso contacts. Thus, attaching the form to parts of the seat cushion that contact the dummy's thighs would not have been allowed. Such a prohibition does not appear warranted, since attaching the form to surfaces other than "contactable" ones meets the goal of the requirement that the purchaser will notice and handle the form when detaching it.

Text and format. The NPRM sought to standardize the text and format of the registration form to increase the likelihood that the purchaser will fill it in. The agency proposed a two-sided, two-part form that consisted of a motivational message and boxed statement (top part) and a postcard that the purchaser would fill in and mail (bottom part). NHTSA proposed the two-part form to ensure that the information on the form can be easily read, and that the allotted space for the purchaser's name and address would be sufficiently large to permit the easy, legible recording of all the necessary information.

Several commenters questioned the need to standardize the form. Cosco said that each manu-

facturer may have differing needs for the forms, which calls for flexibility. Ford Motor Company said that manufacturers should be allowed to use either a fold-over card or a two-part form, and that details of the proposed form should be optional to allow manufacturers the flexibility to design a form that would better facilitate the recording of the information from registrants.

In contrast, Safety Belt Safe said that a definite, prescribed format is desirable because it "fits with the public image of important, official forms," which will encourage people to register.

NHTSA is requiring the form to be standardized to increase the likelihood that a purchaser will register. The National Analysts study showed that essentially the same text and format as those adopted in this rule were effective in presenting the necessary information legibly and eliciting a favorable response from the purchaser, factors that are needed to maximize registration rates.

The focus groups widely and enthusiastically accepted the text and format of the parts of the form that did not vary among the proposed options (*Id.* at 10-14). (The reaction to the part of the form that varied is also discussed below.) National Analysts found that the participants unanimously praised the boxed statement (top part of proposed Figure 9b—the address side of the form). "The boxed message...clearly and effectively communicates what are perceived to be the two most critical messages contained on the registration cards: That it is important...[and] [t]hat this is a recall registration, not a warranty card." *Id.* at 10.

The part of the form that the purchaser fills in (bottom part of proposed figure 9a, the product identification number and purchaser information side) was found to draw—

> a particularly positive response because it requires minimal information and effort to complete...CSS owners praise the fact that they are only required to fill in their name and address....There is a strong preference to have the serial, model number and manufacturing date preprinted on the card as indicated on the prototypes. Nearly all want the numbers printed on the card. They feel that it saves them the trouble of looking--and that any marginal addition of time and effort serves as a potential barrier to completion and return. *Id.* at 12-14.

The portion of the form indicating that the registration postcard is prestamped and preaddressed "is considered essential...Reaction to this was uniformly enthusiastic." *Id.* at 12.

Because the focus groups' response to the text and format of the unvarying parts of the proposed form was extremely positive, NHTSA is requiring use of the text and format. Prescribing the text and format has the added benefit of ensuring that commercial matters, such as marketing information, are excluded from the form. (In addition, the regulatory text expressly prohibits such information. *See,* S5.8(c).) If marketing information were allowed to be placed on the form, such information might cause purchasers to misidentify the registration form as a warranty card, which the agency seeks to avoid in view of National Analysts' finding that participants generally had negative feelings toward warranty registrations (*Id.* at 14).

The rule prescribes the text and format for the motivational message, the part of the form that varied among the proposed options. National Analysts found that it is possible for the text and format of the message to elicit a negative response from the purchaser. The text for option two was widely criticized as appearing shallow or manipulative. *Id.* at 19. The text for option three was strongly criticized for its wording, tone and format. Focus group participants said that they would not read option three's message because of their dislike for the card. *Id.* at 20-22. These findings lead NHTSA to conclude that the text and format and text for the message must be prescribed so that the message itself does not discourage purchasers from registering.

The motivational message has elements that received general support in the National Analysts study. *Id.* at 28. The text is based on option 1, which received the most positive response in the focus group testing. *Id.* at 15. However, the focus groups found the text style of option 1 too hard to read. They preferred a bold print, and that the text be arranged in more of the "bullet" style of option 2. The agency has revised the format in accordance with those preferences.

The motivational message adopted today was suggested by National Analysts in its February 1991 report. National Analysts made the suggestion after evaluating the reaction of the focus groups to the messages proposed as options in the NPRM. Contrary to one commenter's belief,

NHTSA did not receive National Analysts' suggestion for the "optimal" card until after the NPRM was developed. For that reason, the optimal card was not among those proposed in the NPRM. However, NHTSA placed the National Analysts report in the public docket when the NPRM was published, to make the card and the report publicly available for review. See item number three in the NPRM docket, 74-09-N20.

One commenter suggested that the card should have a sentence in Spanish that directs the reader to a resource for a translated version of the registration form. The effect of such a requirement would be to require manufacturers to have forms available in Spanish. The burden of such a requirement on manufacturers does not appear warranted, for the reasons discussed in the agency's November 20, 1990 denial of Texas's petition for rulemaking on requirinq Spanish instructions for child restraints. 55 FR 48262.

The focus group study showed that participants reacted favorably to the idea of being assured by the manufacturer that their names would not be placed on a mailing list if they registered their restraints. Although the agency is not restricting use of the names, it expects that manufacturers will respect owners' preferences that their names be kept separate from other customer lists.

This rule specifies a minimum size for the form so that the part to be returned to the manufacturer would be mailable as a postcard. That part of the form, i.e., the postcard part, and the part of the form to which the postcard is attached must both be not less than 3 1/2 by 5 inches, and have a thickness of not less than 0.007 inches and not more than 0.0095 inches. These dimensions are taken from postal regulations for cards mailable without envelopes under first class postage.

2. *Labeling requirements.*

The NPRM proposed requirements to enable owners of secondhand restraints to register. The NPRM proposed that each restraint (other than factory-installed built-in ones) must be permanently labeled with information about the importance of registration, and instructions for telephoning or mailing the necessary registration information to the manufacturer. In addition, the labeling would have to include information about NHTSA's Auto Safety Hotline. The proposal also included requirements that the registration information be provided in the printed instructions that accompany the restraint.

Several commenters said that the proposed labeling is too long for the limited space available on the restraint, or has words that imply that the restraint is unsafe. NHTSA has shortened and revised the message in response to those comments. Some commenters suggested a new text and format and other changes (e.g., using a triangular warning symbol) that they believed would more effectively urge the purchaser to register. The agency reviewed the suggestions, but could not conclude that the suggestions improved what had been proposed, tested in the focus groups and revised for this rule.

Fisher Price said that labeling the NHTSA Hotline number is unnecessary since the owner can contact the manufacturer about recalls. The agency disagrees. The Hotline number is necessary to increase the public's awareness of that recall information resource. Also, consumer complaints to the Hotline have historically provided NHTSA an important source of data on safety-related defects. For that reason, the agency requires vehicle manufacturers to include the Hotline in the vehicle owner's manual. See 49 CFR Part 575. NHTSA is requiring the Hotline number on each child restraint to ensure that the Hotline can be readily used by each owner, even persons owning secondhand restraints that are missing the instructions.

This rule also requires manufacturers to provide a mailing address and telephone number on the label. The NPRM proposed either an address or telephone number, but several commenters said that both should be required to enable the owner to contact the manufacturer in more than one way. The CAS said that two companies (Virso/Pride-Trimble and Century) recently changed their toll-free telephone numbers which made it more difficult for owners to contact the companies. CAS stated, "Requiring *both* company address and telephone number will help consumers get the information they need." NHTSA is requiring both an address and telephone number to make it easier for a person to register.

Readers should note that Standard 213's labeling requirements are further amended by a final rule published elsewhere in today's edition of the *Federal Register*. That rulemaking relates to a warning label requirement in the standard. In addition, NHTSA published an NPRM to amend

certain labeling and other requirements for built-in restraint systems. 57 FR 870; January 9, 1992. Any amendments that might ultimately be adopted based on the January 1992 notice may modify existing labeling requirements, including the requirements adopted today.

3. Recordkeeping.

This rule establishes a new Part 588 in title 49, CFR, to require manufacturers to establish a record of registrants and maintain this record for at least six years from the date of manufacture of the seat. The record includes the name and mailing address of each registrant, and the model name or number and date of manufacture (month, year) of the restraint.

The notice proposed an eight year period, but comments were requested on whether a shorter period, e.g., six years, should be required. Commenters were sharply divided about the recordkeeping requirement. Commenters suggested a length of recordkeeping ranging from four to 10 years.

The agency is adopting a six year requirement because NHTSA's records indicate that all restraints recalled to date were recalled within six years of the production date of the seat. (As stated above, during 1981-1991, almost 18 million child restraints were recalled. The average length of time between date of production and date of recall was about 28 months.) Some commenters said that a 10 year requirement is warranted because restraints more than 10 years old are still being used. NHTSA does not agree that those restraints, relatively few in number, justify recordkeeping for longer than six years, given the average age of recalled child restraints. NHTSA is concerned that a period longer than six years could impose an unwarranted recordkeeping burden on manufacturers.

Costs.

The agency has revised its cost estimates for this rulemaking. The NPRM and preliminary regulatory evaluation (PRE) estimated that the rule would have an average cost impact of $0.25 to $0.31 per seat. The estimated cost was $0.13 to $0.19 for high volume sales, $0.33 to $0.39 for medium volume sales, and $0.93 to $0.99 for low volume sales. The estimate included the cost for providing and attaching the registration form, labeling the restraint, recordkeeping, and providing postage. The ranges in the cost estimate were based on a 20 percent to 40 percent return rate for the forms.

Evenflo and Cosco disagreed with NHTSA's cost estimates. Evenflo said that the estimated cost for the low volume manufacturer was too low. Evenflo also said that the agency's estimate does not account for the cost doubling or tripling for each level of the distribution chain through which the restraint passes. "The ultimate cost to the consumer (assuming that the cost is passed on the consumer) will actually be three to ten times the estimated $1 cost."

Cosco said that the agency's estimated costs are too low. Cosco believed that the true manufacturing costs would be about $1.00 per seat. "This cost translates into a retail price increase of as much as 10 percent for the moderately priced restraints and considerably more than that for lower-priced booster seats and infant-only restraints, which very well might result in lower purchases of new car seats."

NHTSA contacted Evenflo and Cosco for information about their cost estimates. Evenflo provided information showing some of the basis for its estimate. Cosco did not.

The agency used the information from Evenflo to revise the cost estimates. The final regulatory evaluation for this rule discusses the cost estimates in detail. The evaluation, available in the docket, explains that NHTSA did not agree with some of Evenflo's assumptions about costs. For example, the manufacturer's estimate for postage costs was very high. However, Evenflo's information enabled NHTSA to estimate that the rule will cost $0.47 to $0.52 per restraint for high volume manufacturers, and $0.95 to $1.26 for medium volume manufacturers. These costs are based on a manufacturing cost of $0.20 to $0.22 per restraint for high volume manufacturers, and $0.40 to $0.53 for medium volume manufacturers. The agency determined the retail cost increase based on Evenflo's information that the markup from manufacturing cost to retail price is 2.37 times.

These costs were based on a 30 to 40 percent return rate for the forms. The agency has decided to change the estimated return rate for the child restraint registration forms from 20 to 40 percent in the NPRM, to 30 to 40 percent, since, as explained above the percentage of the remedied seats has increased.

Nomenclature unchanged.

The NPRM proposed a nomenclature change to Standard 213, to replace the term "child restraint system" with "child safety seat." Two commenters supported the change. About nine commenters ranging from manufacturers to researchers to safety groups adamantly opposed it. Many of the commenters opposing the change said the term child safety seat could mislead consumers into believing that the device will provide absolute protection in a crash. Manufacturers said that such an expectation of absolute protection could result in severe liability implications for them in the event a child is injured or killed in the device. Some commenters said that the term child safety seat is not descriptive enough to make clear that it covers devices such as car beds, vests and harnesses. As a result, the term would be confusing in Standard 213.

By proposing the nomenclature change, the agency sought to get consumers to better understand the importance of the seat to the child's safety in the automobile and on aircraft. NHTSA did not intend to change manufacturers' potential legal liability, nor did NHTSA intend to unsettle or confuse the current understanding concerning which devices are included within the term "child restraint systems." While the effectiveness of child restraints is beyond question in view of data indicating they reduce a child's risk of death or serious injury by 70 percent, the agency agrees that the proposed nomenclature change could be confusing, and defers to commenters' assessment that the change might have unintended, undesirable effects on manufacturers' legal liability. NHTSA is therefore retaining the term "child restraint system" in Standard 213.

The final rule does not have any retroactive effect. Under section 103(d) of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1392(d)), whenever a Federal motor vehicle safety standard is in effect, a state may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard. Section 105 of the Act (15 U.S.C. 1394) sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

In consideration of the foregoing, NHTSA amends 49 CFR Part 571 as set forth below:

1. S4 is amended by adding the following definition:

Factory-installed built-in child restraint system means a built-in child restraint system that was installed in a motor vehicle at the time of its delivery to a dealer or distributor for distribution.

2. S5.5.1 is revised to read as follows:

S5.5.1 Each add-on child restraint system shall be permanently labeled with the information specified in S5.5.2(a) through (m).

3. S5.5.2 is amended by replacing the reference to paragraph "(l)" in the introductory paragraph with a reference to paragraph "(m)," by redesignating the existing text in paragraph (m) as paragraph (n), and by adding new paragraph (m), to read as follows:

S5.5.2 The information specified in paragraphs (a) through (m) of this section shall be stated in the English language and lettered in letters and numbers that are not smaller than 10 point type and are on a contrasting background.

* * * * *

(m) The following statement, inserting an address and telephone number: "Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to (*insert address*) or call (*insert telephone number*). For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area)."

(n) Child restraint systems that are certified as complying with the provisions of section S8 shall be labeled with the statement "THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES AND AIRCRAFT." This statement shall be in red lettering, and shall be placed after the certification statement required by paragraph (e) of this section.

4. S5.5.4 is revised to read as follows:

S5.5.4 Each built-in child restraint system shall be permanently labeled with the information specified in S5.5.5(a) through (j) so that it is visible when

the seat is activated for use as specified in S5.6.2, and, except a factory-installed built-in restraint, shall be permanently labeled with the information specified in S5.5.5(k).

5. S5.5.5 is amended by revising the introductory text and adding paragraph (k) to read as follows:

S5.5.5 The information specified in paragraphs (a) through (k) of this section shall be stated in the English language and lettered in letters and numbers that are not smaller than 10-point type and are on a contrasting background. The information specified in paragraphs (a) through (j) shall be printed in the vehicle's owner's manual.

* * * * *

(k) The following statement, inserting an address and telephone number: ''Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to (*insert address*) or call (*insert telephone number*). For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area).''

6. S5.6 would be amended by adding paragraph S5.6.1.7 and S5.6.2.2, to read as follows:

S5.6 *Printed instructions for proper use.*

* * * * *

S5.6.1.7 The instructions shall include the following statement, inserting an address and telephone number: ''Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to (*insert address*) or call (*insert telephone number*). For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area).''

* * * * *

6.2.2 The instructions for each built-in child restraint system, except a factory-installed restraint, shall include the following statement, inserting an address and telephone number: ''Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to (*insert address*) or call (*insert telephone number*). For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area).''

* * * * *

7. A new paragraph S5.8 is added to 571.213 to read as follows:

S5.8 Information requirements—registration form.

(a) Each child restraint system, except a factory-installed built-in restraint system, shall have a registration form attached to any surface of the restraint that contacts the dummy when the dummy is positioned in the system in accordance with S6.1.2 of Standard 213.

(b) Each form shall:

(1) Consist of a postcard that is attached at a perforation to an informational card;

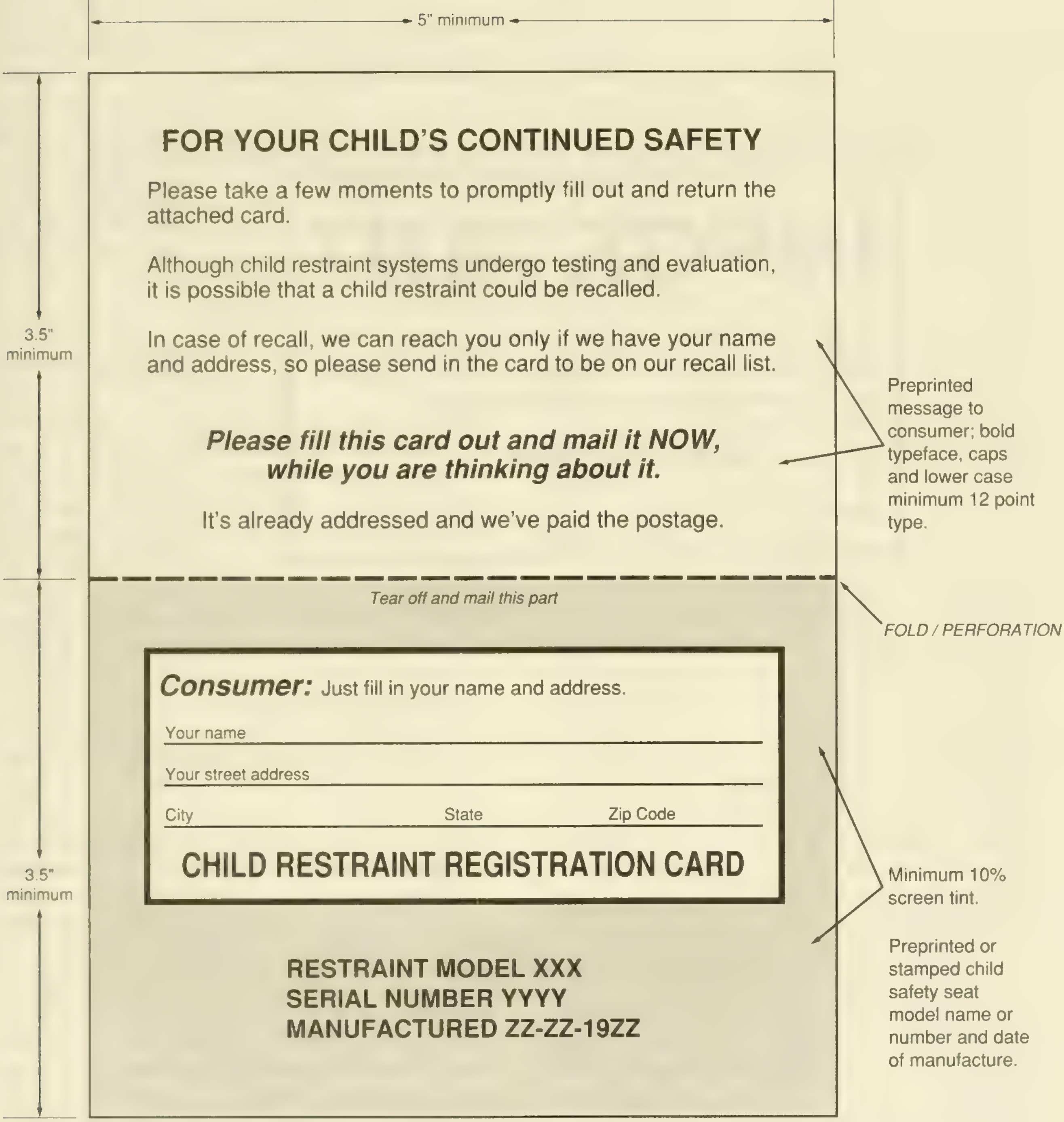
(2) Conform in size, content and format to Figures 9a and 9b; and

(3) Have a thickness of at least 0.007 inches and not more than 0.0095 inches.

(c) Each postcard shall provide the model name or number anddate of manufacture (month, year) of the child restraint system to which the form is attached, shall contain space for the purchaser to record his or her name and mailing address, shall be addressed to the manufacturer, and shall be postage paid. No other information shall appear on the postcard, except identifying information that distinguishes a particular child restraint system from other systems of that model name or number may be preprinted in the shaded area of the postcard, as shown in figure 9a.

Figures 9a and 9b are added to 571.213.

57 F.R. 41428
Septmber 10, 1992



5" minimum

3.5" minimum

FOR YOUR CHILD'S CONTINUED SAFETY

Please take a few moments to promptly fill out and return the attached card.

Although child restraint systems undergo testing and evaluation, it is possible that a child restraint could be recalled.

In case of recall, we can reach you only if we have your name and address, so please send in the card to be on our recall list.

Please fill this card out and mail it NOW, while you are thinking about it.

It's already addressed and we've paid the postage.

Preprinted message to consumer; bold typeface, caps and lower case minimum 12 point type.

Tear off and mail this part

FOLD / PERFORATION

3.5" minimum

Consumer: Just fill in your name and address.

Your name

Your street address

City State Zip Code

CHILD RESTRAINT REGISTRATION CARD

Minimum 10% screen tint.

RESTRAINT MODEL XXX
SERIAL NUMBER YYYY
MANUFACTURED ZZ-ZZ-19ZZ

Preprinted or stamped child safety seat model name or number and date of manufacture.

Figure 9a—Registration Form for Child Systems—Product Identification Number and Purchaser Information Side.

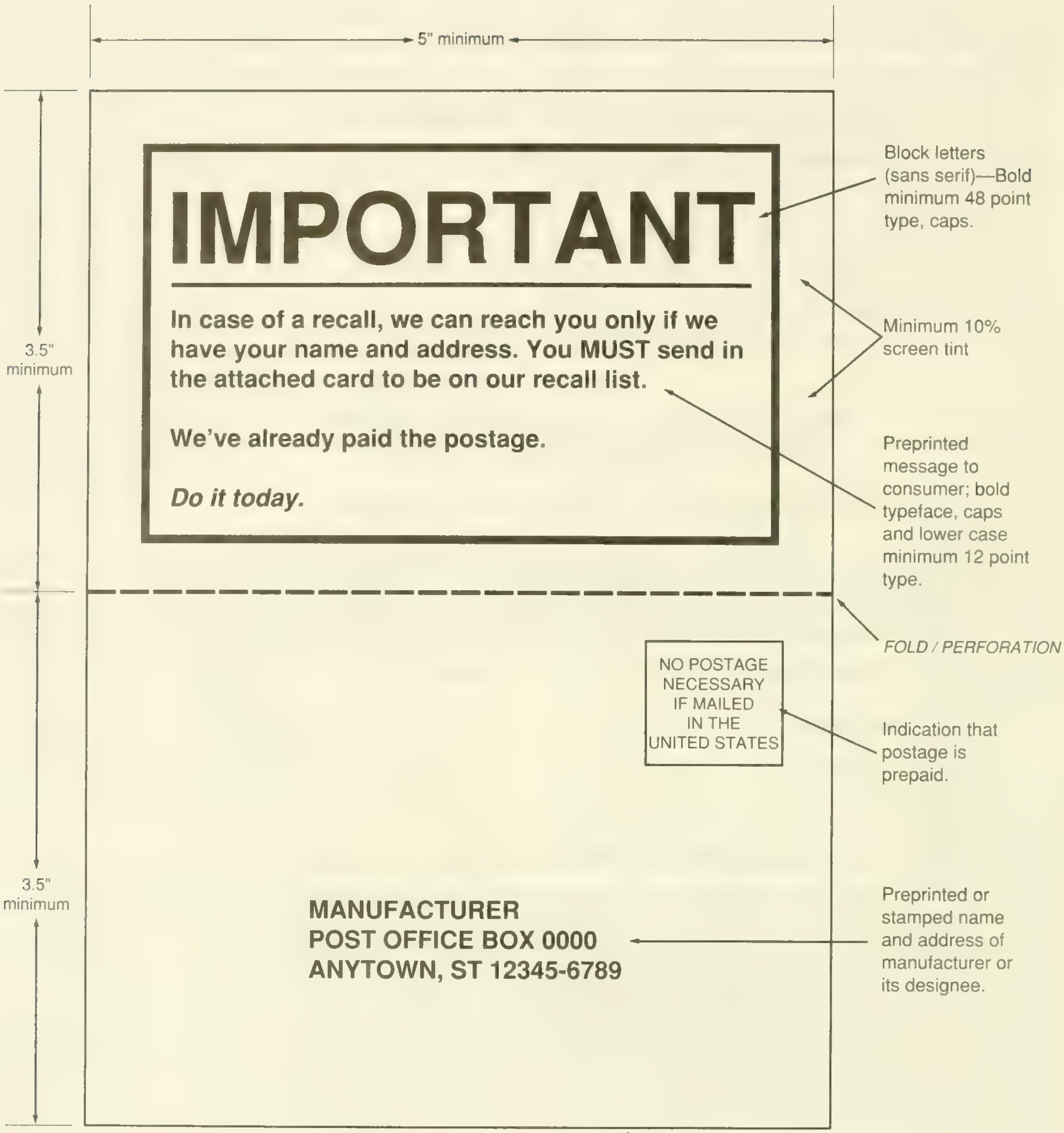


Figure 9b—Registration Form for Child Restraint Systems—Address Side.

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Child Restraint Systems

(Docket No. 74-09; Notice 27)
RIN: 2127-AD45

ACTION: Final rule.

SUMMARY: This rule amends Federal Motor Vehicle Safety Standard 213, *Child Restraint Systems*, to require add-on child restraints to meet the requirements of the standard at each of the angles to which the seat back can be adjusted and at each of the restraint belt routing positions. This amendment improves safety by removing the possibility that a child restraint can be designed to transport a child in a motor vehicle or aircraft while the restraint is adjusted to a position in which the restraint would not comply with the standard.

DATES: The amendment is effective on March 9, 1993.

SUPPLEMENTARY INFORMATION: This rule amends S5 of Standard 213, *Child Restraint Systems*, to expand the requirements for child restraint systems manufactured for use in motor vehicles, and motor vehicles and aircraft.

The requirements are expanded to apply to previously-excluded adjustment positions on child restraints. Child restraint systems typically have more than one seat back angle adjustment position and a number of restraint belt routing positions. Under the standard before this amendment, adjustment positions could be excluded from the excursion (S5.1.3) and seat inversion (S8.2) requirements of the standard if the manufacturer warned that the positions were not for use in motor vehicles or aircraft. This rule eliminates that exclusion of adjustment positions, regardless of whether the manufacturer provides a warning.

This rule also removes the related provisions (S5.5.2(i), S8.1) that required manufacturers of restraints with excluded adjustment positions to identify those positions on labels attached to the restraints. This rule also amends the conditions for the dynamic systems test and the inversion test to clarify the effect of removing these provisions.

The proposal for this rule was published on August 12, 1991 (56 FR 38105). NHTSA began this action in response to a petition for rulemaking from Consumer Action (CA) and the Center for Auto Safety (CAS).

Background

This rulemaking highlights the relationship between the test procedures specified in Standard 213 and the performance required of a child restraint system. The National Traffic and Motor Vehicle Safety Act requires child restraint manufacturers to certify each restraint as complying with Standard 213. NHTSA checks the validity of the certification by evaluating the restraint's performance when tested in accordance with the procedures specified in the standard (S6, S8). Generally, the procedures for the dynamic sled and seat inversion tests specify that the restraint be installed on a simulated car or aircraft seat "in accordance with the manufacturer's instructions" provided to the consumer. (However, the procedures for the dynamic sled test require that most restraints must be secured using only the standard vehicle lap belt. *See*, S6.1.2.1.1(a)) The procedures also specify that the test dummy used to test the restraint is positioned "according to the instructions for child positioning" provided by the manufacturer to the consumer. (See. e.g., S6.1.2.3.1, 6.1.2.3.2 and 6.1.2.3.3.) The installation instructions must provide a narrative discussion and diagrams to facilitate installing the restraint in motor vehicles or aircraft, positioning a child in the restraint and adjusting the restraint to fit the child (S5.6.1 and S8.1).

Each adjustment position of a child restraint is currently subject to dynamic testing unless the restraints manufacturer does not intend that position to be used in motor vehicles or aircraft and

expressly states that intent on a label attached to the restraint. If the position is not intended to be so used, it is excluded from the standard's occupant excursion (S5.1.3) and inversion (S8.2) requirements. The purpose of the excursion and inversion requirements is to ensure that the child occupant is retained within the system in a crash.

Consumer Action and CAS requested that NHTSA amend Standard 213 by removing the provision, S5.5.2(i), which requires manufacturers to warn consumers, by way of a warning label on the restraint, against using an adjustment position in a vehicle if the manufacturer deems the position is unsuitable for such use. The petitioners believed that the S5.5.2(i) warning label is insufficient to ensure that a child restraint system will not be used in the restricted positions in a motor vehicle. It appeared that the basis for the petition was the petitioners' belief that warning labels are generally ineffective.

NHTSA issued a notice of proposed rulemaking (NPRM) to further consider the issue of restricted adjustment positions. NHTSA did not agree with the petitioners that warning labels are generally insufficient to produce desired behaviors. However, the agency was concerned about positions that are unsuitable for vehicle use, yet are made a part of a child restraint system for no reason that outweighs the likelihood that the seat will be misused and the risk to safety unacceptably increased. (56 FR at 38106.)

NHTSA developed a proposal to achieve the purpose of the requested amendment. With regard to restraints for motor vehicles, NHTSA proposed to amend S5.1.3, *Occupant excursion*, to remove the provision that excludes the restricted positions from the excursion requirement. Since the exclusion would be removed, NHTSA also proposed to remove S5.5.2(i), the labeling provision for restricting a position. To make clear the effect of these amendments, NHTSA proposed to amend S5 to require each restraint to "meet the requirements in [S5] at all adjustment positions (including, but not limited to each seat back angle adjustment position and each restraint belt anchorage and routing position), when tested in accordance with S6.1" of Standard 213.

With regard to restraints for aircraft, the NPRM proposed similar amendments. The NPRM proposed to remove the provision in Standard 213 that excludes restricted adjustment positions from the inversion test requirement (S8.2) and to remove the warning label requirement in S8.1.

In issuing the NPRM, NHTSA believed that most manufacturers had ceased designing child restraints with adjustment positions not intended for motor vehicle and aircraft use. However, the agency tentatively concluded the amendments were needed to ensure that no restricted position would be included in future restraint systems. *Id.*

Comments on the NPRM

NHTSA received comments from CAS, Advocates for Highway and Auto Safety, Cosco, Ford Motor Company, and the University of Michigan. These entities generally supported the NPRM, with comments relating to particular issues raised by the proposal.

Effect of S5

Cosco and the University of Michigan suggested that the language of the proposed amendment to S5 was unclear and overbroad. Cosco said that a number of adjustment positions on its child restraints could be unintentionally affected by the proposed S5, and that convertible restraints might be especially affected. (Convertible restraints are restraints designed for use by both infants and toddlers. For most convertible restraints, certain restraint adjustment positions are designed for infants only, while other positions are suitable for toddlers only.) Emphasizinq that the NPRM stated convertible restraints serve a safety need, Cosco argued that their manufacture should be not prohibited.

Cosco gave several examples of how it believed that the proposed language of S5 would create uncertainty about the permissibility of certain adjustment positions on convertible restraints. Cosco said that its "Dream Ride" restraint is a "car seat/car bed with an upright, rear-facing position and fully reclined, side-facing position." The instructions for the restraint state that it should not be used in a front-to-back position when fully reclined, i.e., placed in a vehicle so that its and the vehicle's longitudinal axes are parallel.

The commenter believed that the proposed language would subject the fully reclined position to Standard 213 requirements in the front-to-back position on the standard seat assembly. Cosco suggested that S5 should expressly permit manufacturers to "designate... that certain weights and

seating positions are not acceptable under certain conditions, as long as there are no adjustment positions available which cannot be used in motor vehicles under any conditions.''

To address Cosco's concerns, NHTSA has made several changes. The agency has revised the amendment to S5. The amendment retains the existing statement in S5 about child restraint requirements:

> Each child restraint system certified for use in motor vehicles shall meet the requirements in this section when, as specified, tested in accordance with S6.1.

In addition, the agency is adding a statement specifying that each add-on system shall meet the requirements of S5 at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended for use (e.g., forward, rearward or laterally) pursuant to S5.6, and used with the test dummy specified in S7 of the standard.

Under the first sentence in S5, the orientation and adjustment of a child restraint for compliance testing purposes is determined based upon the instructions given by manufacturers to consumers regarding the installation and use of that restraint. The second sentence qualifies the first sentence by limiting the extent to which a manufacturer's instructions affect how and to what extent a child restraint is subject to testing under the standard. Under the second sentence, regardless of the manufacturer's instructions, a child restraint is subject to testing in all seat back angles and belt routing positions. However, a manufacturer's instructions about a matter such as restraint orientation will still affect compliance testing. For example, if a manufacturer's instructions state that a car bed is to be installed side-to-side (perpendicular to the vehicle's longitudinal axis), but not front-to-back (parallel to that axis), the car bed will be subject to testing in the side-to- side orientation only.

It does not appear, however, that the originally proposed amendment to S5 would have caused the seat positioning problems Cosco described for its Dream Ride restraint. The proposed text retained the present provision in S5 that restraints are ''tested in accordance with S6.1,'' the section in the standard that specifies the test conditions and procedures for the dynamic systems test. Under S6.1, a restraint is installed on a simulated vehicle seat in accordance with the manufacturer's instructions. A restraint that is designed to be adjusted to different configurations for different child weights is oriented forward, rearward or laterally, depending on the manufacturer's instructions for using the restraint.

The University of Michigan (UM) suggested S5 would be clearer if it stated: ''Each child restraint system certified for use in motor vehicles shall meet the requirements in this section at each adjustment position (...) in at least one type of vehicle (ground or aircraft) when tested in accordance with the procedures of S6.1 for at least one specified range of child weight.'' As amended today, S5 is similar to UM's suggested text. However, the agency has not adopted the ''ground or aircraft'' language suggested by the commenter. When a manufacturer certifies its restraint as complying with the requirements for restraints for aircraft, the manufacturer states: ''THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES *AND* AIRCRAFT.'' (S5.5.2(m); emphasis added.) An adjustment position that meets Standard 213 for aircraft use but not for vehicle use would not be acceptable under the standard.

Other amendments

This rule makes conforming changes to the test procedures for the excursion and inversion requirements. Currently, the test dummy used to test to these requirements is positioned in the restraint according to the manufacturer's instructions for child positioning. Under today's amendment, each of the restraint's seat back angles and belt routing positions will be subject to testing, notwithstanding the manufacturer's instructions not to use those adjustment positions in vehicles or aircraft.

Aircraft use

Cosco commented that the proposed amendment to the requirements for restraints certified for aircraft use would have a negative impact on its Dream Ride restraint. NHTSA disagrees.

Cosco said it currently informs the consumer that the restraint should be used on aircraft only in the partially upright (rear-facing) position. Cosco said that it does not recommend the fully reclined position on aircraft since two aircraft seats are needed to accommodate the restraint in that adjustment position and consumers are unlikely to purchase those seats. Cosco indicated

that the Dream Ride performs adequately in the car bed position, if the two aircraft seats are used. The commenter was concerned that it would have to eliminate the fully reclined position because the position is one that is not intended for use in aircraft.

NHTSA does not seek to have Cosco eliminate the fully reclined position on its restraint, or remove the Dream Ride from the models of restraints certified for both motor vehicles and aircraft. Safety is furthered by the availability of restraints manufactured for both vehicles and aircraft.

NHTSA does seek to ensure through today's amendment to the aircraft requirements that each seat back angle and belt routing position in restraints manufactured for both vehicles and aircraft passes the inversion requirement when tested according to the procedures in the standard. Cosco indicated that the Dream Ride, fully reclined, would pass the inversion test while fully-reclined and positioned crosswise, on two aircraft seats. If that is the case, the restraint already complies with the standard's amended aircraft requirements. As long as the restraint passes while fully reclined and positioned crosswise, the existence of that adjustment position does not prohibit Cosco from manufacturing and selling that child restraint. Further, nothing prohibits Cosco from recommending in its information to consumers that the seat not be used in that orientation on aircraft. Thus, the restraint must meet the inversion test in all of its back angles and belt routing positions. For example, the Dream Ride could be tested fully reclined with the six-month-old dummy while positioned crosswise, on two aircraft seats, even if Cosco recommends the fully reclined position not be used on aircraft.

Built-in restraint systems

Ford said the proposed amendments to S5 could complicate testing of built-in child restraints that form part of a reclining vehicle seat. Ford stated:

> Built-in child restraints can be installed in vehicle seats that can be adjusted to positions that are not intended for use while the vehicle is moving. For example, many vehicle seats can be reclined to allow weary drivers and passengers to rest at highway rest areas.

Ford suggested that the proposed amendment expressly apply to add-on restraints only. The commenter believed such application was intended by the agency, since no mention was made in the preamble for the NPRM about built-in restraints.

Ford also asked about an apparent discrepancy between the effect of the proposed S5 on built-in restraints and the specified test conditions (S6.1.1) for testing the restraints. The proposed S5 would have required built-in restraints to meet the standard's requirements "at all adjustment positions" when tested in accordance with the conditions and procedures of S6.1. However, under S6.1, if a specific vehicle is used (the second of two standard test devices that can be used, at the manufacturer's option, to test a built-in system), a built-in system is tested with the vehicle seat "in the manufacturer's nominal design riding position." Stated differently, S6.1 provides for testing only one adjustment position.

Ford is correct that the agency intended only to address add-on systems in this rulemaking action. NHTSA did not consider how the proposed amendment would affect adjustment positions on built-in seats. For those seats, a reclining vehicle seat back may also be the seat back of a child restraint built into the vehicle seat.

A built-in system that is part of a seat with a reclining seat back would probably fail to meet the standard if the seat back were reclined and if today's rule applied to it. Such an amendment could have required some redesigning of seats. The agency is uncertain whether there is sufficient reason to disallow the reclining feature. Reclining seats let weary drivers and passengers rest at highway rest areas (as discussed by Ford in its comment). Indeed, NHTSA has observed that some reclining seat backs in vans recline all the way down to the horizontal position so as to create a sleeping surface stretching from the rear of the third seating surface to the front of the second seating surface. Reclining seats also provide for easier loading of the vehicle.

Use of a built-in restraint when the vehicle seat back is reclined at a sharp angle would be undesirable. However, until the agency learns that vehicles being driven with children in such reclined positions occurs frequently enough to become a significant problem, the relative merits of the reclining vehicle seat need not be further addressed. There is sufficient justification for the reclinability of such seats to warrant their exclusion from today's S5 amendments. However,

NHTSA recommends that manufacturers warn consumers against using an adjustment position on a built-in restraint while the vehicle is in motion if the position cannot provide adequate protection.

In response to an issue raised by Ford in its comment, today's rule adopts a technical amendment to the standard's test conditions for built-in restraints. As stated above, Standard 213 permits manufacturers the option of choosing to test a built-in system with the specific vehicle shell or the specific vehicle. (S6.1.1.1(a).) Ford pointed out that the conditions under which a built-in system is tested using the shell are inconsistent with those under which the vehicle is tested.

The conditions are specified in much greater details for the vehicle test than the shell test. Some of the conditions are appropriate for the vehicle and not for the shell, e.g., vehicle loading specifications. However, many of the conditions specified in the vehicle test are relevant for the shell test but are not specified for the latter. For example, conditions for the longitudinal and vertical seat positioning, and seat back adjustment position, are relevant yet unspecified.

As a practical matter, the lack of specifications is inconsequential. The test procedures for built-in restraints direct NHTSA to "activate the restraint in the specific vehicle shell or the specific vehicle, in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2." (See S6.1.2.1.1 and S6.1.2.1.2.) Under these instructions, the vehicle seat that contains the built-in child restraint generally would be adjusted as the manufacturer directs. for both the vehicle and the shell tests.

This rule makes the test conditions for the vehicle and shell tests consistent, in response to Ford's request that the conditions be clarified. The amendment is merely technical; the agency believes there will be no changes in the manner in which built-in restraints are tested.

Other comments

NHTSA stated in the NPRM that the agency conducted an informal survey of 15 restraint systems, and did not find any currently being manufactured that is labeled with the S5.5.2(i) warning. 56 FR at 38106. Both CAS and Advocates for Highway-and Auto Safety (Advocates) said that NHTSA should survey all child seat manufacturers to determine whether restraints are being sold with restricted adjustment positions.

NHTSA does not believe an additional survey is necessary. Child restraint manufacturers did not question the validity of the agency's survey, except to point out the issue about built-in restraints, discussed above. An additional survey is unlikely to yield knowledge more useful than the information that the agency already possesses.

CAS and Advocates commented also on issues that were outside the scope of the rulemaking proposal. They concurred with NHTSA that convertible restraints should continue to be available to consumers. However, both organizations suggested further large-scale testing of the restraints by NHTSA. CAS said the agency should determine whether the seats "provide adequate protection in any adjustment position." Advocates urged NHTSA to conduct tests on whether convertible seats are being properly used by the consumer. CAS and Advocates also commented on improving Standard 213's labeling requirements. Both said the agency should guide the industry toward developing improved consumer information on the appropriate use of a restraint system.

NHTSA regards these comments as suggestions for future rulemaking. The agency has placed copies of the comments in NHTSA docket 74-O9-N21, which relates to planned research and possible upgrades to Standard 213.

Typographical correction

No comments were received on the proposed correction of S5.3.1. The correction is made in this rule.

Concurrent amendments

Readers should note that Standard 213's labeling requirements are further amended by a final rule published elsewhere in today's edition of the *Federal Register*. That rulemaking relates to an owner registration requirement for child restraint systems. In addition, NHTSA published an NPRM to amend certain labeling and other requirements for built-in restraint systems. 57 FR 87O; January 9, 1992. Any amendments that might ultimately be adopted based on the January 1992 notice may modify existing labeling requirements, including the requirements adopted today.

This final rule does not have any retroactive effect. Under § 103(d) of the National Traffic and

Motor Vehicle Safety Act (15 U.S.C. 1392(d)), whenever a Federal motor vehicle safety standard is in effect, a state may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard. Section 105 of the Act (15 U.S.C. 1394) sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

In consideration of the foregoing, NHTSA amends 49 CFR part 571 as set forth below.

1. The authority citation for part 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.§ 571.213 [Amended]

2. The introductory text of S5 is revised to read as follows:

S5 *Requirements for child restraint systems certified for use in motor vehicles.* Each child restraint system certified for use in motor vehicles shall meet the requirements in this section when, as specified, tested in accordance with S6.1 and this paragraph. Each add-on system shall meet the requirements at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., forward, rearward or laterally) pursuant to S5.6, and tested with the test dummy specified in S7.

3. S5.1.3 is revised to read as follows:

S5.1.3 *Occupant excursion.* When tested in accordance with S6.1, each child restraint system shall meet the applicable excursion limit requirements specified in S5.1.3.1- S5.1.3.3.

4. S5.3.1 is revised to read as follows:

* * * * *

S5.3.1 Each add-on child restraint system shall have no means designed for attaching the system to a vehicle seat cushion or vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back.

* * * * *

5. S5.5.2(i) is removed and reserved.

6. S5.5.5(g) is revised to read as follows:

* * * * *

(g) The statement specified in paragraph (1), and if appropriate, the statement in paragraph (2):

(1) WARNING! FAILURE TO FOLLOW THE MANUFACTURER'S INSTRUCTIONS ON THE USE OF THIS CHILD RESTRAINT SYSTEM CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH.

(2) In the case of each built-in child restraint system which is not intended for use in the motor vehicle at certain adjustment positions, the following statement, inserting the manufacturer's adjustment restrictions.

DO NOT USE THE ——— ADJUSTMENT POSITION(S) OF THIS CHILD RESTRAINT WHILE THE VEHICLE IS IN MOTION.

* * * * *

7. S6.1.1.1(a) through the introductory text of S6.1.1.1(c) is revised to read as follows:

* * * * *

S6.1.1.1(a) The test device for add-on restraint systems is the standard seat assembly specified in S7.3. The assembly is mounted on a dynamic test platform so that the center SORL of the seat is parallel to the direction of the test platform travel and so that movement between the base of the assembly and the platform is prevented.

(b) The test device for built-in child restraint systems is either the specific vehicle shell or the specific vehicle.

(1)(i) The specific vehicle shell, if selected for testing, is mounted on a dynamic test platform so that the longitudinal center line of the shell is parallel to the direction of the test platform travel and so that movement between the base of the shell and the platform is prevented. Adjustable seats are in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost position, the closest adjustment position to the rear of the midpoint is used. Adjustable seat backs are in the manufacturer's nominal design riding position. If such a position is not specified, the seat back is positioned so that the longitudinal center line of the child test dummy's neck is vertical, and if an instrumented test dummy is used, the acceler-

ometer surfaces in the dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle seat is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

(ii) The platform is instrumented with an accelerometer and data processing system having a frequency response of 60 Hz channel class as specified in Society of Automotive Engineers Recommended Practice J211 JUN80 "Instrumentation for Impact Tests." The accelerometer sensitive axis is parallel to the direction of test platform travel.

(2) For built-in child restraint systems, an alternate test device is the specific vehicle into which the built-in system is fabricated. The following test conditions apply to this alternate test device.

* * * * *

8. In S6.1.1, S6.1.1.5 is added to read as follows:

* * * * *

S6.1.1.5 In the case of add-on child restraint systems, the restraint shall meet the requirements of S5 at each of its seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., forward, rearward or laterally) pursuant to S5.6, and tested with the test dummy specified in S7.

9. S8.1 is revised to read as follows:

S8.1 *Installation instructions.* Each child restraint system manufactured for use in aircraft shall be accompanied by printed instructions in English that provide a step-by-step procedure, including diagrams, for installing the system in aircraft passenger seats, securing a child in the system when it is installed in aircraft, and adjusting the system to fit the child.

10. S8.2 is revised to read as follows:

S8.2 *Inversion test.* When tested in accordance with S8.2.1 through S8.2.5, each child restraint system manufactured for use in aircraft shall meet the requirements of S8.2.1 through S8.2.6. The manufacturer may, at its option, use any seat which is a representative aircraft passenger seat within the meaning of S4. Each system shall meet the requirements at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., facing forward, rearward or laterally) pursuant to S8.1, and tested with the test dummy specified in S7. If the manufacturer recommendations do not include instructions for orienting the restraint in aircraft when the restraint seat back angle is adjusted to any position, position the restraint on the aircraft seat by following the instructions (provided in accordance with S5.6) for orienting the restraint in motor vehicles.

Issued on: September 4, 1992.

Howard M. Smolkin
Executive Director

57 F.R. 41423
September 10, 1992

FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213
Child Restraint Systems, Seat Belt Assemblies, and Anchorages

(Docket No. 74–9; Notice 26)
RIM: 2127–AD46

S1. Scope. This standard specifies requirements for child restraint systems used in motor vehicles and aircraft.

S2. Purpose. The purpose of this standard is to reduce the number of children killed or injured in motor vehicle crashes and in aircraft.

S3. Application. This standard applies to child restraint systems for use in motor vehicles and aircraft.

S4. Definitions. *Add-on child restraint system* means any portable child restraint system.

Booster seat means a child restraint which consists of only a seating platform that does not extend up to provide a cushion for the child's back or head.

Built-in child restraint system means any child restraint system which is an integral part of a passenger car.

Car bed means a child restraint system designed to restrain or position a child in the supine or prone position on a continuous flat surface.

Child restraint system means any device, except Type I or Type II seat belts, designed for use in a motor vehicle or aircraft to restrain, seat, or position children who weigh 50 pounds or less.

Contactable surface means any child restraint system surface (other than that of a belt, belt buckle, or belt adjustment hardware) that may contact any part of the head or torso of the appropriate test dummy, specified in S7, when a child restraint system is tested in accordance with S6.1. [*Factory-installed built-in child restraint system* means a built-in child restraint system that was installed in a motor vehicle at the time of its delivery to a dealer or distributor for distribution. **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)**]

Representative aircraft passenger seat means either a Federal Aviation Administration approved production aircraft passenger seat or a simulated aircraft passenger seat conforming to Figure 6.

Seat orientation reference line or *SOR* means the horizontal line through Point Z as illustrated in Figure 1A.

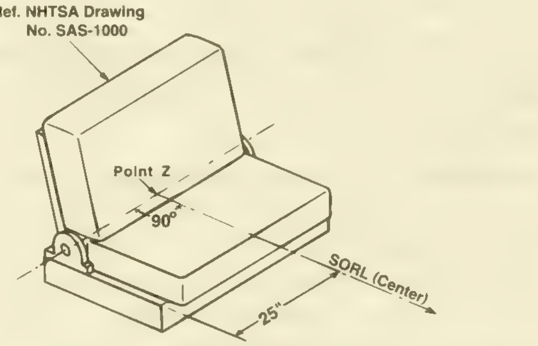


Figure 1A—SORL Location on the Standard Seat

Specific vehicle shell means the actual vehicle model part into which the built-in child restraint system is fabricated, including the complete surroundings of the built-in system. If the built-in child restraint system is manufactured as part of the rear seat, these surroundings include the back of the front seat, the interior rear side door panels and trim, the rear seat, the floor pan, the B and C pillars, and the ceiling. If the built-in system is manufactured as part of the front seat, these surroundings include the dashboard; the steering wheel, column, and attached levers and knobs; the ''A'' pillars; any levers and knobs installed in the floor or on a console; the interior front side door panels and trim; the front seat; the floor pan; and the ceiling.

Torso means the portion of the body of a seated anthropomorphic test dummy, excluding the thighs, that lies between the top of the child

restraint system seating surface and the top of the shoulders of the test dummy.

S5. Requirements for child restraint systems certified for use in motor vehicles. [Each child restraint system certified for use in motor vehicles shall meet the requirements in this section when, as specified, tested in accordance with S6.1. and this paragraph. Each add-on system shall meet the requirements at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., forward, rearward or laterally) pursuant to S5.6, and tested with the test dummy specified in S7. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)**]

S5.1 Dynamic performance.

S5.1.1 Child restraint system integrity. When tested in accordance with S6.1, each child restraint system shall;

(a) Exhibit no complete separation of any load bearing structural element and no partial separation exposing either surfaces with a radius of less than ¼ inch or surfaces with protrusions greater than ⅜ inch above the immediate adjacent surrounding contactable surface of any structural element of the system;

(b) If adjustable to different positions, remain in the same adjustment position during the testing as it was immediately before the testing; and

(c) If a front facing child restraint system, not allow the angle between the system's back support surfaces for the child and the system's seating surface to be less than 45 degrees at the completion of the test.

S5.1.2 Injury criteria. When tested in accordance with S6.1, each child restraint system that, in accordance with S5.5.2(f), is recommended for use by children weighing more than 20 pounds, shall—

(a) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy head as specified in Part 572 such that the expression:

$$\left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a dt \right]^{2.5} (t_2 - t_1)$$

shall not exceed 1,000, where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2, are any two moments during the impacts.

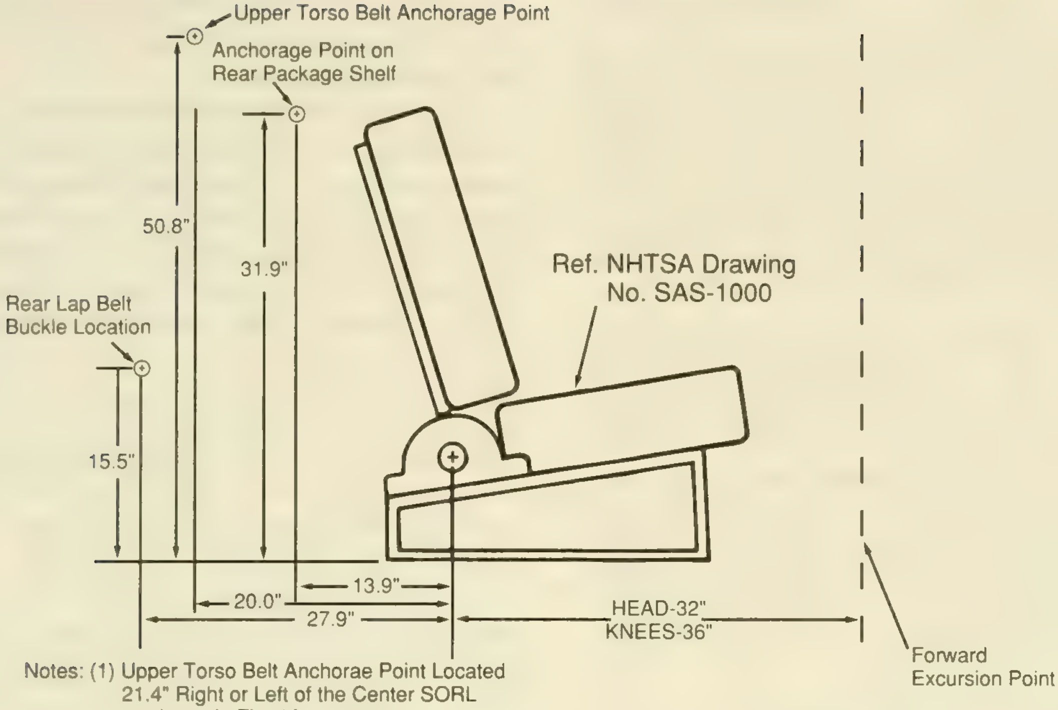
(b) Limit the resultant acceleration at the location of the accelerometer mounted in the test dummy upper thorax as specified in Part 572 to not more than 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S5.1.3 Occupant excursion. [When tested in accordance with S6.1, each child restraint system shall meet the applicable excursion limit requirements specified in S5.1.3.1–S5.1.3.3. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)**]

S5.1.3.1 Child restraint systems other than rear-facing ones and car beds. Each child restraint system, other than a rear-facing child restraint system or a car bed, shall retain the test dummy's torso within the system.

(a) In the case of an add-on child restraint system, no portion of the test dummy's head shall pass through the vertical transverse plane that is 32 inches forward of point Z on the standard seat assembly, measured along the center SORL (as illustrated in Figure 1B), and neither knee pivot point shall pass through the vertical, transverse plane that is 36 inches forward of point Z on the standard seat assembly, measured along the center SORL.

(b) In the case of a built-in child restraint system, neither knee pivot shall pass through a vertical, transverse plane that is 36 inches forward of the hinge point of the specific passenger car seat into which the system is built, measured along a horizontal line parallel to the vehicle's longitudinal center line and the center line of the passenger car seat.



Notes: (1) Upper Torso Belt Anchorae Point Located 21.4" Right or Left of the Center SORL as shown in Fig. 1A
(2) Rear Lap Belt Buckle Located 7.0" Right or Left of the Center SORL as shown in Fig. 1A

Figure 1B—Locations of Additional Belt Anchorage Points and Forward Excursion Limit

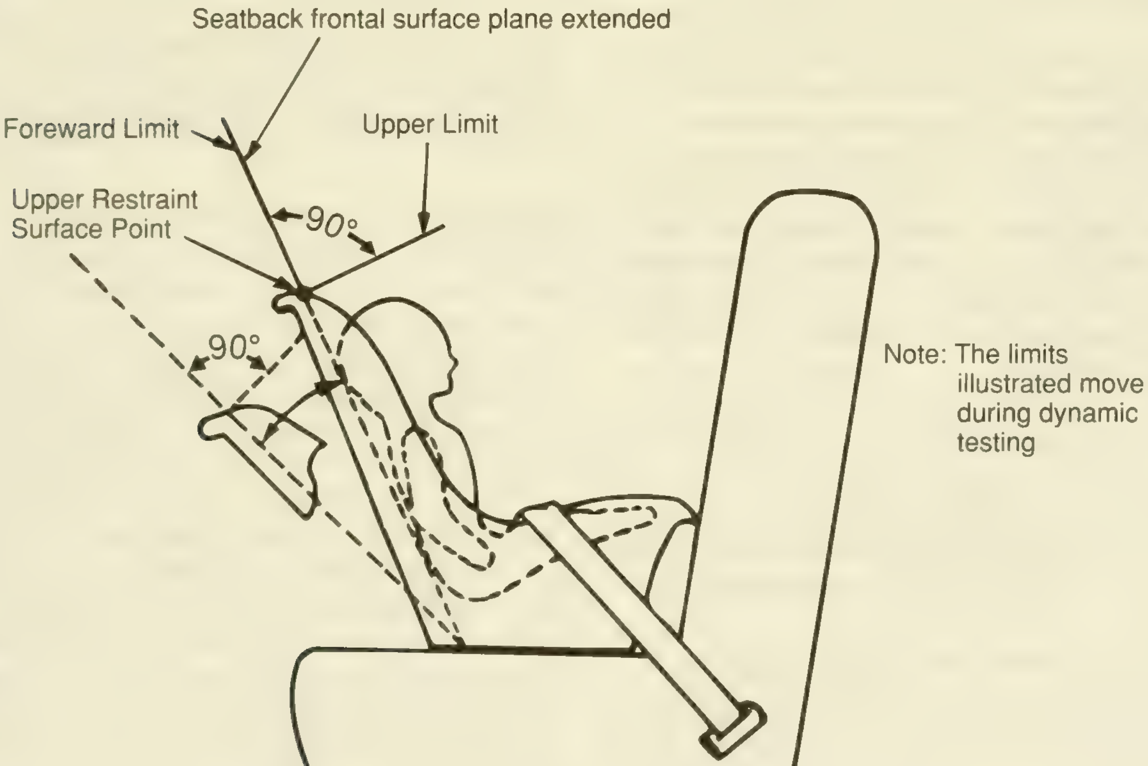


Figure 1C—Rear Facing Child Restraint Forward and Upper Head Excursion Limits

S5.1.3.2 Rear-facing child restraint systems. In the case of each rear-facing child restraint system, all portions of the test dummy's torso shall be retained within the system and no portion of the target point on either side of the dummy's head shall pass through the transverse orthogonal planes whose intersection contains the forward-most and top-most points on the child restraint system surfaces (illustrated in Figure 1C).

S5.1.3.3 Car beds. In the case of car beds, all portions of the test dummy's head and torso shall be retained within the confines of the car bed.

S5.1.4 Back support angle. When a rear-facing child restraint system is tested in accordance with S6.1, the angle between the system's back support surface for the child and the vertical shall not exceed 70 degrees.

S5.2 Force distribution.

S5.2.1 Minimum head support surface-child restraints other than car beds.

S5.2.1.1 Except as provided in S5.2.1.2, each child restraint system other than a car bed shall provide restraint against rearward movement of the head of the child (rearward in relation to the child) by means of a continuous seat back which is an integral part of the system and which—

(a) Has a height, measured along the system seat back surface for the child in the vertical longitudinal plane passing through the longitudinal centerline of the child restraint systems from the lowest point on the system seating surface that is contacted by the buttocks of the seated dummy, as follows:

Weight [1] (in pounds)	Height [2] (in inches)
Less than 20 lb	18
20 lb or more, but not more than 40 lb	20
More than 40 lb	22

[1] When a child restraint system is recommended under S5.5(f) for use by children of the above weights.
[2] The height of the portion of the system seat back providing head restraint shall not be less than the above.

(b) Has a width of not less than 8 inches measured in the horizontal plane at the height specified in paragraph (a) of this section. Except that a child restraint system with side supports extending at least 4 inches forward from the padded surface of the portion of the restraint system provided for support of the child's head may have a width of not less than 6 inches, measured in the horizontal plane of the height specified in paragraph (a) of this section.

(c) Limits the rearward rotation of the test dummy head so that the angle between the head and torso of the dummy specified in 57 when tested in accordance with S6.1 is not more than 45 degrees greater than the angle between the head and torso after the dummy has been placed in the system in accordance with S6.1.2.3 and before the system is tested in accordance with S6.1.

S5.2.1.2 [A front facing child restraint system is not required to comply with S5.2.1.1 if the target point on either side of the dummy's head is below a horizontal plane tangent to the top of—

(a) The standard seat assembly, in the case of an add-on child restraint system, when the dummy is positioned in the system and the system is installed on the assembly in accordance with S6.1.2.

(b) The passenger car seat, in the case of a built-in child restraint system, when the system is activated and the dummy is positioned in the system in accordance with S6.1.2. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)]**

S5.2.2 Torso impact protection. Each child restraint system other than a car bed shall comply with the applicable requirements of S5.2.2.1 and S5.2.2.2.

S5.2.2.1 (a) The system surface provided for the support of the child's back shall be flat or concave and have a continuous surface area of not less than 85 square inches.

(b) Each system surface provided for support of the side of the child's torso shall be flat or concave and have a continuous surface of not less than 24 square inches for systems recommended for children weighing 20 pounds or more, or 45 square inches for systems recommended for children weighing less than 20 pounds.

(c) Each horizontal cross section of each system surface designed to restrain forward movement of the child's torso shall be flat or concave and each vertical longitudinal cross section shall be flat or convex with a radius of curvature of the underlying structure of not less than 2 inches.

S5.2.2.2 [Each forward-facing child restraint system shall have no fixed or movable surface—

(a) Directly forward of the dummy and intersected by a horizontal line—

(1) Parallel to the 5ORL, in the case of the add-on child restraint system, or

(2) Parallel to a vertical plane through the longitudinal center line of the passenger car seat, in the case of the built-in child restraint system, and (b) Passing through any portion of the dummy, except for surfaces which restrain the dummy when the system is tested in accordance with S6.1.2.1.2, so that the child restraint system shall conform to the requirements of S5.1.2 and S5.1.3.1. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)]**

S5.2.3 Head Impact protection.

S5.2.3.1 Each child restraint system, other than a child harness, which is recommended under S5.5.2(f) for children weighing less than 20 pounds shall comply with S5.2.3.2.

S5.2.3.2 Each system surface, except for protrusions that comply with S5.2.4, which is contactable by the dummy head when the system is tested in accordance with S6.1 shall be covered with slow recovery, energy absorbing material with the following characteristics:

(a) A 25 percent compression-deflection resistance of not less than 0.5 and not more than 10 pounds per square inch when tested in accordance with S6.3.

(b) A thickness of not less than ½ inch for material having a 25 percent compression-deflection resistance of not less than 1.5 and not more than 10 pounds per square inch when tested in accordance with S6.3. Materials having a 25 percent compression-deflection resistance of less than 1.8 pounds per square inch shall have a thickness of not less than ¾ inch.

S5.2.4 Protrusion limitation. Any portion of a rigid structural component within or underlying a contactable surface, or any portion of a child restraint system surface that is subject to the requirements of S5.2.3 shall, with any padding or other flexible overlay material removed, have a height above any immediately adjacent restraint system surface of not more than ⅜ inch and no exposed edge with a radius of less than ¼ inch.

S5.3 Installation.

S5.3.1 Each [add-on] child restraint system shall have no means designed for attaching the system to vehicle seat cushion or vehicle seat back and no component (except belts) that is designed to be inserted between the vehicle seat cushion and vehicle seat back. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)**

S5.3.2 When installed on a vehicle seat, each [add-on] child restraint system, other than child harnesses, shall be capable of being restrained against forward movement solely by means of a Type I seat belt assembly (defined in S571.209) that meets Standard No. 208 (S571.208), or by means of a Type I seat belt assembly plus one additional anchorage strap that is supplied with the system and conforms to S5.4. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)**

S5.3.3 Car beds. Each car bed shall be designed to be installed on a vehicle seat so that the car bed's longitudinal axis is perpendicular to a vertical longitudinal plane through the longitudinal axis of the vehicle.

S5.4 Belts, belt buckles, and belt webbing.

S5.4.1 Performance requirements. The webbing of belts provided with a child restraint system and used to attach the system to the vehicle or to restrain the child within the system shall—

(a) After being subjected to abrasion as specified in § 5.1(d) or 5.3(c) of FMVSS No. 209 (§ 571.209), have a breaking strength of not less than 75 percent of the strength of the unbraided webbing when tested in accordance with S5.1(b) of FMVSS No. 209.

(b) Meet the requirements of S4.3 (e) through (h) of FMVSS No. 209 (S571.209); and

(c) If contactable by the test dummy torso when the system is tested in accordance with S6.1, have a width of not less than 1½ inches when measured in accordance with S5.4.1.1.

S5.4.1.1 Width test procedure. Condition the webbing for 24 hours in an atmosphere of any relative humidity between 48 and 67 percent, and any ambient temperature between 70° and 77° F. Measure belt webbing width under a tension of 5 pounds applied lengthwise.

S5.4.2 Belt buckles and belt adjustment hardware. Each belt buckle and item of belt adjustment hardware used in a child restraint system shall conform to the requirements of S4.3 (a) and S4.3 (b) of FMVSS No. 209 (S571.209).

S5.4.3 Belt Restraint.

S5.4.3.1 General. Each belt that is part of a child restraint system and that is designed to restrain a child using the system shall be adjustable to snugly fit any child whose height and weight are within the ranges recommended in accordance with S5.5.2 (f) and who is positioned in the system in accordance with the instructions required by S5.6.

S5.4.3.2 Direct restraint. [Each belt that is part of a child restraint system and that is designed to restrain a child using the system and to attach the system to the vehicle shall, when tested in accordance with S6.1, impose no loads on the child that result from the mass of the system, or

(a) in the case of an add-on child restraint system, from the mass of the seat back of the standard seat assembly specified in S7.3, or (b) in the case of a built-in child restraint system, from the mass of any part of the vehicle into which the child restraint system is built. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)]**

S5.4.3.3 Seating systems. Except for child restraint systems subject to S5.4.3.4, each child restraint system that is designed for use by a child in a seated position and that has belts designed to restrain the child shall, with the test dummy specified in S7 positioned in the system in accordance with S6.1.2.3, provide:

(a) upper torso restraint in the form of:

(i) belts passing over each shoulder of the child; or

(ii) a fixed or movable surface that complies with S5.2.2.1(c), and

(b) lower torso restraint in the form of:

(i) a lap belt assembly making an angle between 45° and 90° with the child restraint seating surface at the lap belt attachment points, or

(ii) a fixed or movable surface that complies with S5.2.2.1(c), and

(c) in the case of each seating system recommended for children over 20 pounds, crotch restraint in the form of:

(i) a crotch belt connectable to the lap belt or other device used to restrain the lower torso, or

(ii) a fixed or movable surface that complies with S5.2.2.1(c).

S5.4.3.4 Harnesses. Each child harness shall:

(a) Provide upper torso restraint, including belts passing over each shoulder of the child;

(b) Provide lower torso restraint by means of lap and crotch belt; and

(c) Prevent a child of any height for which the restraint is recommended for use pursuant to S5.5.2(f) from standing upright on the vehicle seat when the child is placed in the device in accordance with the instructions required by S5.6.

S5.4.3.5 Buckle Release. Any buckle in a child restraint system belt assembly designed to restrain a child using the system shall:

(a) When tested in accordance with S6.2.1 prior to the dynamic test of S6.1, not release when a force of less than 9 pounds is applied and shall release when a force of not more than 14 pounds is applied:

(b) After the dynamic test of S6.1, when tested in accordance with S6.2.3, release when a force of not more than 16 pounds is applied;

(c) Meet the requirements of S4.3(d)(2) of FMVSS No. 209 (S571.209), except that the minimum surface area for child restraint buckles designed for push-button application shall be 0.6 square inch.

(d) Meet the requirements of S4.3(g) of FMVSS No. 209 (S571.209) when tested in accordance with S5.2(g) of FMVSS No. 209; and

(e) Not release during the testing specified in S6.1.

S5.5 Labeling.

S5.5.1 Each [add-on] child restraint system shall be permanently labeled with the information specified in S5.5.2 (a) through (I). **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)**

S5.5.2 The information specified in paragraphs (a)–(m) of this section shall be stated in the English language and lettered in letters and numbers that are not smaller than 10 point type and are on a contrasting background.

(a) The model name or number of the system.

(b) The manufacturer's name. A distributor's name may be used instead if the distributor assumes responsibility for all duties and liabilities imposed on the manufacturer with respect to the system by the National Traffic and Motor Vehicle Safety Act, as amended

(c) The statement: "Manufactured in ——," inserting the month and year of manufacture.

(d) The place of manufacture (city and State, or foreign country). However, if the manufacturer uses the name of the distributor, then it shall state the location (city and State, or foreign country) of the principal offices of the distributor.

(e) The statement: "This child restraint system conforms to all applicable Federal motor vehicle safety standards."

(f) One of the following statements, inserting the manufacturer's recommendations for the maximum weight and height of children who can safely occupy the system:

(i) This infant restraint is designed for use by children who weigh ________ pounds or less and whose height is ________ inches or less; or

(ii) This child restraint is designed for use only by children who weigh between ________ and ________ pounds and whose height is ________ inches or less and who are capable of sitting upright alone; or

(iii) This child restraint is designed for use only by children who weigh between ________ and ________ pounds and are between and ___inches in height.

(g) The following statement, inserting the location of the manufacturer's installation instruction booklet or sheet on the restraint:

WARNING! FAILURE TO FOLLOW EACH OF THE FOLLOWING INSTRUCTIONS CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH.

SECURE THIS CHILD RESTRAINT WITH A VEHICLE BELT AS SPECIFIED IN THE MANUFACTURER'S INSTRUCTIONS LOCATED ________

(h) In the case of each child restraint system that has belts designed to restrain children using them:

SNUGLY ADJUST THE BELTS PROVIDED WITH THIS CHILD RESTRAINT AROUND YOUR CHILD.

(i) **[Reserved]**

(j) In the case of each child restraint system equipped with an anchorage strap, the statement: SECURE THE TOP ANCHORAGE STRAP PROVIDED WITH THIS CHILD RESTRAINT AS SPECIFIED IN THE MANUFACTURER'S INSTRUCTIONS.

(k) In the case of each child restraint system which can be used in a rear-facing position, one of the following statements:

(i) PLACE THIS CHILD RESTRAINT IN A REAR-FACING POSITION WHEN USING IT WITH AN INFANT; or

(ii) PLACE THIS INFANT RESTRAINT IN A REAR-FACING POSITION WHEN USING IT IN THE VEHICLE.

(l) An installation diagram showing the child restraint system installed in the right front outboard seating position equipped with a continuous-loop lap/shoulder belt and in the center rear seating position as specified in the manufacturer's instructions. [(m) The following statement, inserting an address and telephone number: "Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to *(insert address)* or call *(insert telephone number)*. For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area)." **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]**

(n) Child restraints that are certified as complying with the provisions of section S8 shall be labeled with the statement "THIS RESTRAINT IS CERTIFIED FOR USE IN MOTOR VEHICLES AND AIRCRAFT". This statement shall be in red lettering, and shall be placed after the certification statement required by paragraph (e) of this section.

S5.5.3 The information specified in S5.5.2 (g)–(k) shall be located on the add-on child restraint system so that it is visible when the system is installed as specified in S5.6.1.

S5.5.4 [Each build-in child restraint system shall be permanently labeled with the information specified in S5.5.5(a) through (j), so that it is visible when the system is activated for use as specified in S5.6.2., and, except a factory-installed built-in restraint, shall be permanently labeled with the information specified in S5.5.5(k). **(57**

F.R. 41428—September 10, 1992. Effective: March 9, 1993)]

S5.5.5 [The information specified in paragraphs (a) through (k) of this section shall be stated in the English language and lettered in letters and numbers which are not smaller than 10-point type and are on a contrasting background. This information specified in paragraphs (a) through (j) shall be printed in the vehicle owner's manual. **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]**

(a) The model name or number of the system.

(b) The manufacturer's name. A distributor's or dealer's name may be used instead if the distributor or dealer assumes responsibility for all duties and liabilities imposed on the manufacturer with respect to the system by the National Traffic and Motor Vehicle Safety Act, as amended.

(c) The statement: "Manufactured in ______," inserting the month and year of manufacture.

(d) The place of manufacture (city and State, or foreign country). However, if the manufacturer uses the name of the distributor or dealer, then it shall state the location (city and State, or foreign country) of the principal offices of the distributor or dealer.

(e) The statement: "This child restraint system conforms to all applicable Federal motor vehicle safety standards.

(f) One of the following statements, inserting the manufacturer's recommendations for the maximum weight and height of children who can safely occupy the system:

(i) This infant restraint is designed for use by children who weigh ____ pounds or less and whose height is ____ inches or less;

(ii) This child restraint is designed for use only by children who weigh between ____ and ____ pounds and whose height is ____ inches or less and who are capable of sitting upright alone; or

(iii) This child restraint is designed for use by children who weigh between ____ and ____ pounds and are between ____ and ____ inches in height.

(g) [The statement specified in paragraph (1), and if appropriate, the statement in paragraph (2):

(i) WARNING! FAILURE TO FOLLOW THE MANUFACTURER'S INSTRUCTIONS ON THE USE OF THIS CHILD RESTRAINT SYSTEM CAN RESULT IN YOUR CHILD STRIKING THE VEHICLE'S INTERIOR DURING A SUDDEN STOP OR CRASH.

(ii) In the case of each built-in child restraint system which is not intended for use in the motor vehicle at certain adjustment positions, the following statement, inserting the manufacturer's adjustment restrictions. DO NOT USE THE ____ ADJUSTMENT POSITION(S) OF THIS CHILD RESTRAINT WHILE THE VEHICLE IS IN MOTION. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)]**

(h) In the case of each build-in child restraint system that has belts designed to restrain children using them:

SNUGLY ADJUST THE BELTS PROVIDED WITH THIS CHILD RESTRAINT AROUND YOUR CHILD.

(i) In the case of each built-in child restraint which can be used in a rear, facing position, the following statement:

PLACE AN INFANT IN A REAR-FACING POSITION IN THIS CHILD RESTRAINT.

(j) A diagram or diagrams showing the fully activated child restraint system in infant and/or child configurations. [(k) The following statement, inserting an address and telephone number: "Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to *(insert address)* or call *(insert telephone number)*. For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area)." **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]**

S5.6 Printed Instructions for Proper Use.

S5.6.1 Add-on restraint systems. Each add-on child restraint system shall be accompanied by printed installation instructions in the English language that provide a step-by-step procedure, including diagrams, for installing the system in motor vehicles, securing the system in the vehicles, positioning a child in the system, and adjusting the system to fit the child.

S5.6.1.1 In a vehicle with rear designated seating positions, the instructions shall alert vehicle owners that, according to accident statistics, children are safer when properly restrained in the rear seating positions than in the front seating positions.

S5.6.1.2 The instructions shall specify in general terms the types of vehicles, the types of seating positions, and the types of vehicle safety belts with which the add-on child restraint system can or cannot be used.

S5.6.1.3 The instructions shall explain the primary consequences of not following the warnings required to be labeled on the child restraint system in accordance with S5.5.2(g) through (k).

S5.6.1.4 The instructions for each car bed shall explain that the car bed should position in such a way that the child's head is near the center of the vehicle.

S5.6.1.5 The instructions shall state that add-on child restraint systems should be securely belted to the vehicle, even when they are not occupied, since in a crash an unsecured child restraint system may injure other occupants.

S5.6.1.6 Each add-on child restraint system shall have a location on the restraint for storing the manufacturer's instructions.

[**S5.6.1.7** The instructions shall include the following statement, inserting an address and telephone number: "Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to *(insert address)* or call *(insert telephone number)*. For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area)." **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)**]
(Rev. 9/10/92)

S5.6.2 Built-in child restraint systems. Each built-in child restraint system shall be accompanied by printed instructions in the English language that provide a step-by-step procedure, including diagrams, for activating the built-in child restraint system, positioning a child in the system, adjusting the restraint and, if provided, the restraint harness to fit the child. This information and the information specified in S5.5.5, shall be included in the vehicle owner's manual.

S5.6.2.1 The instructions shall explain the primary consequences of not following the manufacturer's warnings for proper use of the child restraint system in accordance with S5.5.5(f) through (i).

[**S5.6.2.2** The instructions for each built-in child restraint system, except a factory-installed restraint, shall include the following statement, inserting an address and telephone number: "Child restraints could be recalled for safety reasons. You must register this restraint to be reached in a recall. Send your name, address and the restraint's model number and manufacturing date to *(insert address)* or call *(insert telephone number)*. For recall information, call the U.S. Government's Auto Safety Hotline at 1-800-424-9393 (202-366-0123 in D.C. area)." **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)**]

S5.6.3 The instructions shall explain the primary consequences of noting following the warnings required to be labeled on the child restraint system in accordance with S5.5.2 (g)–(k).

S5.6.4 The instructions for each car bed shall explain that the car bed should position in such a way that the child's head is near the center of the vehicle.

S5.6.5 The instructions shall state that child restraint systems should be securely belted to the vehicle, even when they are not occupied, since in a crash an unsecured child restraint system may injure other occupants.

S5.6.6 Each child restraint system shall have a location on the restraint for storing the manufacturer's instructions.

S5.7 Flammability. Each material used in a child restraint system shall conform to the requirements of S4 of FMVSS No. 302 (S571.302). In the case of a built-in child restraint system, the requirements of 54 of FMVSS No. 302 shall be met in both "in-use" and "stowed" positions.

[**S5.8 Information requirements—registration form.**

(a) Each child restraint system, except a factory-installed build-in restraint system, shall have a registration form attached to any surface of the restraint that contacts the dummy when the dummy is positioned in the system in accordance with S6.1.2 of Standard 213.

(b) Each form shall:

(1) Consist of a postcard that is attached at a perforation to an informational card;

(2) Conform in size, content and format to Figures 9a and 9b; and

(3) Have a thickness of at least 0.007 inches and not more than 0.0095 inches. (c) Each postcard shall provide the model name or number and date of manufacture (month, year) of the child restraint system to which the form is attached, shall contain space for the purchaser to record his or her name and mailing address, shall be addressed to the manufacturer, and shall be postage paid. No other information shall appear on the postcard, except identifying information that distinguishes a particular child restraint system from other systems of that model name or number may be preprinted in the shaded area of the postcard, as shown in figure 9a. **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]**

S6. Test Conditions and Procedures.

S6.1 Dynamic Systems Test.

S6.1.1 Test Conditions.

S6.1.1.1 [(a) The test device for add-on child restraint systems is the standard seat assembly specified in S7.3. The assembly is mounted on a dynamic test platform so that the center SORL of the seat is parallel to the direction of the test platform travel and so that movement between the base of the assembly and the platform is prevented.

(b) The test device for built-in child restraint systems is either the specific vehicle shell or the specific vehicle.

(1)(i) The specific vehicle shell, if selected for testing, is mounted on a dynamic test platform so that the longitudinal center line of the shell is parallel to the direction of the test platform travel and so that movement between the base of the shell and the platform is prevented. Adjustable seats are in the adjustment position midway between the forwardmost and rearmost position, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost position, the closest adjustment position to the rear of the midpoint is used. Adjustable seat backs are in the manufacturer's nominal design riding position. If such a position is not specified, the seat back is positioned so that the longitudinal center line of the child test dummy's neck is vertical, and if an instrumented test dummy is used, the accelerometer surfaces in the dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle seat is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

(ii) The platform is instrumented with an accelerometer and data processing system having a frequency response of 60Hz channel class as specified in Society of Automotive Engineers Recommended Practice J211 JUN80 "Instrumentation for Impact Tests." The accelerometer sensitive axis is parallel to the direction of the test platform travel. (2) For built-in child restraint systems, an alternative test device is the specific vehicle into which the built-in system is fabricated. The following test conditions apply to this alternate test device. **(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]**

(c) For built-in child restraint systems, an alternate test device is the specific vehicle into which the build-in system is fabricated. Activate the system in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2. When the complete vehicle traveling longitudinally forward at any speed up to and including 30 mph, impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, the built-in child restraint system shall meet the injury criteria of S5.1.2. The following test conditions apply to this alternate test device.

(i) The vehicle is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the appropriate child test dummy and, at the option of the manufacturer, an anthropomorphic test dummy which conforms to the requirements of Subpart B or Subpart E of Part 572 of this title for a 50th percentile adult male dummy placed in the front outboard seating position. If the built-in child restraint system is installed at one of the seating positions otherwise requiring the placement of a Part 572 test dummy, then in the frontal barrier crash specified in S6.1.1.2, the appropriate child test dummy shall be substituted for the Part 572 test dummy, but only at that seating

position. The fuel tank is filled to any level from 90 to 95 percent of capacity.

(ii) Adjustable seats are in the adjustment midway between the forward-most and rear-most positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forward-most and rear-most positions, the closest adjustment position to the rear of the midpoint is used.

(iii) Adjustable seat backs are iii the manufacturer's nominal design riding position. If a nominal position is not specified, the seat back is positioned so that the longitudinal center line of the child test dummy's neck is vertical, and if an anthropomorphic test dummy is used, the accelerometer surfaces in the test dummy's head and thorax, as positioned in the vehicle, are horizontal. If the vehicle is equipped with adjustable head restraints, each is adjusted to its highest adjustment position.

(iv) Movable vehicle windows and vents are, at the manufacturer's option, placed in the fully closed position.

(v) Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.

(vi) Doors are fully closed and latched but not locked.

(vii) All instrumentation and data reduction is in conformance with SAE J211 JUN80.

S6.1.1.2 [The tests are frontal barrier impact simulations of the test platform or frontal barrier crashes of the specific vehicles as specified in S5.1 (571.208) and for;

(a) Test Configuration I specified in S6.1.2.1.1, are at a velocity change of 30 mph with the acceleration of the test platform entirely within the curve shown in Figure 2, or for the specific vehicle test with the deceleration produced in 30 mph frontal barrier crash. (b) Test Configuration II specified in S6.1.2.1.2 are set at a velocity change of 20 mph with the acceleration of the test platform entirely within the curve shown in Figure 3, or for the specific vehicle test with the deceleration produced in 20 mph frontal barrier crash. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)]**

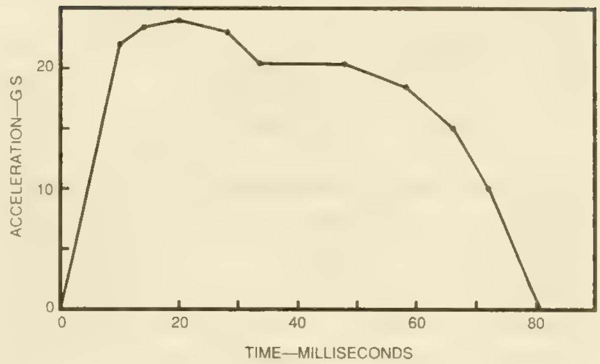


Figure 2

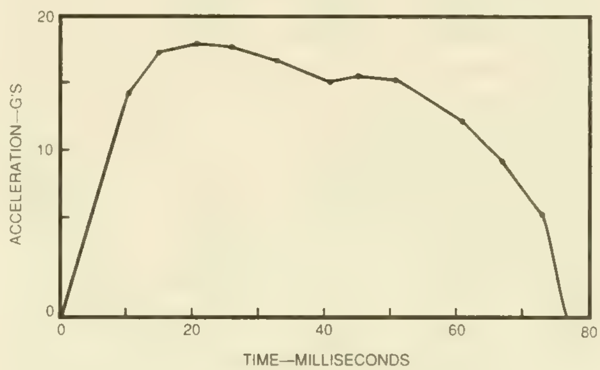


Figure 3

S6.1.1.3 In the case of add-on child restraint systems, Type I seat belt assemblies meeting the requirements of Standard No. 209 (S571.209) and having webbing with a width of not more than 2 inches are attached, without the use of retractors or reels of any kind, to the seat belt anchorage points (illustrated in Figure 1B) provided on the standard seat assembly.

S6.1.1.4 Performance tests under S6.1 are conducted at any ambient temperature from 66° to 78° F and at any relative humidity from 10 percent to 70 percent.

[**S6.1.1.5** In the case of add-on child restraint systems, the restraint shall meet the requirements of S5 at each of its seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., forward, rearward or laterally) pursuant to S5.6, and tested with the test

dummy specified in S7. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)]**

S6.1.2 Dynamic Test Procedure.

S6.1.2.1 Test Configuration.

S6.1.2.1.1 Test Configuration (a) In the case of each add-on child restraint system other than a child harness, a booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children, install a new add-on child restraint system at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6.1, except that the add-on restraint shall be secured to the standard vehicle seat using only the standard vehicle lap belt. A child harness, booster seat with a top anchorage strap, or a restraint designed for use by physically handicapped children shall be installed at the center seating position of the standard seat assembly in accordance with the manufacturer's instructions provided with the system pursuant to S5.6.1.

(b) In the case of each built-in child restraint system, activate the restraint in the specific vehicle shell or the specific vehicle, in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2.

S6.1.2.1.2 Test Configuration II. (a) In the case of each add-on child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, or a booster seat with a top anchorage strap, install a new add-on child restraint system at the center seat position of the standard seat assembly using only the standard seat lap belt to secure the system to the standard seat.

(b) In the case of each built-in child restraint system which is equipped with a fixed or movable surface described in S5.2.2.2, or a built-in booster seat with a top anchorage strap, activate the system in the specific vehicle shell or the specific vehicle in accordance with the manufacturer's instructions provided in the vehicle owner's manual in accordance with S5.6.2.

S6.1.2.2 Tighten all belts used to attach the add-on child restraint system to the standard seat assembly to a tension of not less than 12 pounds and not more than 15 pounds, as measured by a load cell used on the webbing portion of the belt. Tighten all manual vehicle belts used to secure the built-in child restraint system or a child to the specific vehicle shell or specific vehicle to one of the following tensions:

(a) For a seat equipped with a manual adjuster or automatic locking retractor, not less than 12 pounds and not more than 15 pounds, as measured by a load cell used on the webbing portion of the belt;

(b) For a seat equipped with an emergency locking retractor, as specified in S4.3 of Standard 209.

S6.1.2.3 Place in the child restraint any dummy specified in 57 for testing systems for use by children of the heights and weights for which the system is recommended in accordance with S5.6.

S6.1.2.3.1 When placing the 3-year-old test dummy in add-on or built-in child restraint systems other than car beds, position the test dummy according to the instructions for child positioning provided by the manufacturer with the system in accordance with S5.6.1 or S5.6.2 while conforming to the following:

(a) Holding the test dummy torso upright until it contacts the system's design seating surface, place the test dummy in the seated position within the system with the midsagittal plane of the test dummy head—

(i) coincident with the center SORL of the standard seating assembly, in the case of the add-on child restraint system, or

(ii) vertical and parallel to the longitudinal center line of the specific vehicle shell or the specific vehicle, in the case of a built-in child restraint system.

(b) Extend the arms of the test dummy as far as possible in the upward vertical direction. Extend the legs of the dummy as far as possible in the forward horizontal direction, with the dummy feet perpendicular to the centerline of the lower legs.

(c) Using a flat square surface with an area of 4 square inches, apply a force of 40 pounds, perpendicular to:

(i) the plane of the back of the standard seat assembly in the case of an add-on child restraint system, or

(ii) the back of the vehicle seat in the specific vehicle shell or the specific vehicle in the

case of a build-in child restraint system, first against the dummy crotch and then at the dummy thorax in the midsagittal plane of the dummy. For a child restraint system with a fixed or movable surface described in S5.2.2.2 which is being tested under the conditions of test configuration II, do not attach any of the child restraint belts unless they are an integral part of the fixed or movable surface. For all other child restraint systems and for a child restraint system with a fixed or movable surface which is being tested under the conditions of test configuration I, attach all appropriate child restraint belts and tighten them as specified in S6.1.2.4. Attach all appropriate vehicle belts and tighten them as specified in S6.1.2.2. Position each movable surface in accordance with the manufacturer's Instructions provided in accordance with S5.6.1 or S5.6.2.

(d) After the steps specified in paragraph (c) of this section, rotate each dummy limb downwards in the plane parallel to the dummy's midsagittal plane until the limb contacts a surface of the child restraint system or the standard seat assembly in the case of an add-on system, or the specific vehicle shell or specific vehicle in the case of a built-in system, as appropriate. Position the limbs, if necessary, so that limb placement does not inhibit torso or head movement in tests conducted under S6.

S6.1.2.3.2 When placing the 6-month-old dummy in [add-on or built-in] child restraint systems other than car beds, position the test dummy according to the instructions for child positioning provided with the system by the manufacturer in accordance with [S5.6.1 or S5.6.2] while conforming to the following:

(a) With the dummy in the supine position on a horizontal surface, and while preventing movement of the dummy torso by placing a hand on the center of the torso, rotate the dummy legs upward by lifting the feet until the legs contact the upper torso and the feet touch the head, and then slowly release the legs but do not return them to the flat surface.

(b) Place the dummy in the child restraint system so that the back of the dummy torso contacts the back support surface of the system. For a child restraint system with a fixed or movable surface described in S5.2.2.2 which is being tested under the conditions of test configuration II, do not attach any of the child restraint belts unless they are an integral part of the fixed or movable surface. For all other child restraint systems and for a child restraint system with a fixed or movable surface which is being tested under the conditions of test configuration I, attach all appropriate child restraint belts and tighten them as specified in S6.1.2.4. Attach all appropriate vehicle belts and tighten them as specified in S6.1.2.2. Position each movable surface in accordance with the manufacturer's instructions provided in accordance with [S5.6.1 or S5.6.2.] If the dummy's head does not remain in the proper position, it shall be taped against the front of the seat back surface of the system by means of a single thickness of ¼-inch-wide paper masking tape placed across the center of the dummy face. (c) Position the dummy arms vertically upwards and then rotate each arm downward toward the dummy's lower body until it contacts a surface of the child restraint system or the standard seat assembly, [in the case of an add-on child restraint system, or the specific vehicle shell or the specific vehicle in the case of a built-in child restraint system, ensuring that no arm is restrained from movement in other than the downward direction, by any part of the system or the belts used to anchor the system to the standard seat assembly, the specific vehicle shell, or the specific vehicle.] **(53 F.R. 1783—January 22, 1988. Effective: January 22, 1988)**

S6.1.2.3.3 When placing the 6-month-old dummy or 3-year-old dummy in a car bed, place the dummy in the car bed in the supine position with its midsagittal plane perpendicular to the center SORL of the standard seat assembly and position the dummy within the car bed in accordance with instructions for child positioning provided with the car bed by its manufacturer in accordance with S5.6.

S6.1.2.4 If provided, shoulder and pelvic belts that directly restrain the dummy shall be adjusted as follows:

Tighten the belts until a 2-pound force applied (as illustrated in Figure 5) to the webbing at the top of each dummy shoulder and to the pelvic webbing two inches on either side of the torso midsagittal plane pulls the webbing ¼ inch from the dummy.

S6.1.2.5 Accelerate the test platform to simulate frontal impact in accordance with S6.1.1.2 (a) or S6.1.1.2. (b), as appropriate.

S6.1.2.6 [For add-on child restraint systems, measure dummy excursion and determine conformance with the requirements specified in S5.1 as appropriate. For built-in child restraint systems, measure dummy knee excursion and determine conformance with the requirements specified in S5.1 as appropriate. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)**]

S6.2 Buckle release test procedure. The belt assembly buckles used in the child restraint system shall be tested in accordance with S6.2.1 through S6.2.4 inclusive.

S6.2.1 Before conducting the testing specified in S6.1, place the loaded buckle on a hard, flat, horizontal surface. Each belt end of the buckle shall be pre-loaded in the following manner. The anchor end of the buckle shall be loaded with a 2-pound force in the direction away from the buckle. In the case of buckles designed to secure a single latch plate, the belt latch plate end of the buckle shall be pre-loaded with a 2-pound force in the direction away from the buckle. In the case of buckles designed to secure two or more latch plates, the belt latch plate ends of the buckle shall be loaded equally so that the total load is 2 pounds in the direction away from the buckle. For push-button release buckles the release force shall be applied by a conical surface (cone angle not exceeding 90 degrees). For push-button release mechanisms with a fixed edge (referred to in Figure 7 as "hinged button"), the release force shall be applied at the centerline of the button, 0.125 inches away from the movable edge directly opposite the fixed edge, and in the direction that produces maximum releasing effect. For push-button release mechanisms with no fixed edge (referred to Figure 7 as "floating button"), the release force shall be applied at the center of the release mechanism in the direction that produces the maximum releasing effect. For all other buckle release mechanisms, the force shall be applied on the centerline of the buckle lever or finger tab in the direction that produces the maximum releasing effect. Measure the force required to release the buckle. Figure 7 illustrates the loading for the different buckles and the point where the release force should be applied, and Figure 5 illustrates the conical surface used to apply the release force to push-button release buckles.

S6.2.2 After completion of the testing specified in S6.1, and before the buckle is unlatched, tie a self-adjusting sling to each wrist and ankle of the test dummy in the manner illustrated in Figure 4.

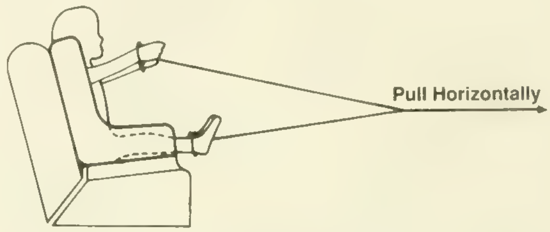


Figure 4—Buckle Release Test

S6.2.3 [Pull the sling horizontally in the manner illustrated in Figure 4 and parallel to the center SORL of the seat assembly, in the case of an add-on child restraint system, or parallel to the longitudinal center line of either the specific vehicle shell or the specific vehicle, in the case of a built-in child restraint system, and apply a force of 20 pounds in the case of a system tested with a 6 month-old dummy and 45 pounds in the case of a system tested with a 3 year-old dummy. **(53 F.R. 1783—January 22, 1988. Effective: January, 22, 1988)**]

S6.2.4 While applying the force specified in S6.2.3, and using the device shown in Figure 8 for push-button release buckles, apply the release force in the manner and location specified in S6.2.1 for that type of buckle. Measure the force required to release the buckle.

S6.3 Head impact protection—energy absorbing material test procedure.

S6.3.1 Prepare and test specimens of the energy absorbing material used to comply with S5.2.3 in accordance with the applicable 25 percent compression-deflection test described in the American Society for Testing and Materials (ASTM) Standard D1056–73, "Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber", or D1564–71. "Standard Method of Testing Flexible Cellular Materials—Slab Urethane Foam" or D1565–76 "Standard Specification for Flexible Cellular Materials—Vinyl Chloride Polymer and Copolymer open-cell foams.

S7 Test dummies.

S7.1 Six-month-old dummy. An unclothed "Six-month-old Size Manikin" conforming to Subpart D of Part 572 of this chapter is used for testing a child restraint system that is recommended by its manufacturer in accordance with S5.6 for use by children in a weight range that includes children weighing not more than 20 pounds.

S7.2 Three-year-old dummy. A three-year-old dummy conforming to Subpart C of Part 572 of this chapter is used for testing a child restraint that is recommended by its manufacturer in accordance with S5.6 for use by children in a weight range that includes children weighing more than 20 pounds.

[(a) *Built-in child restraints.* When a three-year-old test dummy is used for testing a built-in child restraint, the dummy shall be assembled with the head assembly specified in § 572.16(a)(1).

(b) *Add-on child restraints.* Until September 1, 1993, when a three-year-old test dummy is used for testing an add-on child restraint, the dummy shall be assembled using, at the manufacturer's option, either head assembly specified in § 572.16(a). Effective September 1, 1993, when a three-year-old dummy is used for testing an add-on child restraint, the dummy shall be assembled with the head assembly specified in § 572.16(a)(1). **(55 F.R. 30465—July 26, 1990. Effective: August 27, 1990.]**

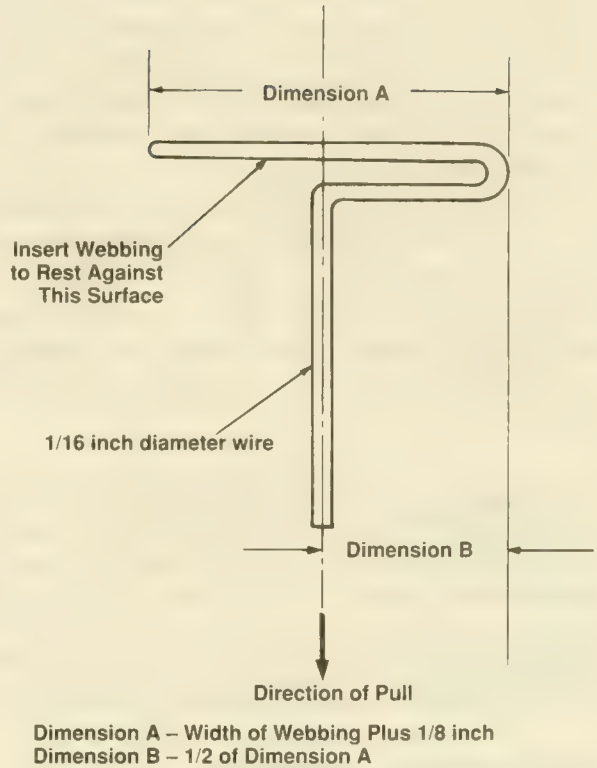


Figure 5—Webbing Tension Pull Device

S7.2.1 Before being used in testing under this standard, the dummy is conditioned at any ambient temperature from 66° F to 78° F and at any relative humidity from 10 percent to 70 percent for at least 4 hours.

S7.2.2 When used in testing under this standard, the dummy is clothed in thermal knit waffle-weave polyester and cotton underwear, a size 4 long-sleeved shirt weighing 0.2 pounds, a size 4 pair of long pants weighing 0.2 pounds and cut off just far enough above the knee to allow the knee target to be visible, and size 7M sneakers with rubber toe caps, uppers of dacron and cotton or nylon and a total weight of 1 pound. Clothing other than the shoes is machine-washed in 160° F to 180° F water and machine dried at 120° F to 140° F for 30 minutes.

S7.3 Standard test devices.

(a) The standard test devices used in testing add-on child restraint systems under this standard are:

(1) For testing for motor vehicle use, a standard seat assembly consisting of a simulated vehicle bench seat, with three seating positions, which is described in Drawing Package SAS–100–1000 (consisting of drawings and a bill of materials); and

(2) For testing for aircraft use, a standard seat assembly consisting of a representative aircraft passenger seat.

(b) The standard test devices used in testing built-in child restraint systems under this standard are either a specific vehicle shell or a specific vehicle.

S8. Requirements, test conditions, and procedures for child restraint systems manufactured for use in an aircraft. Each child restraint system manufactured for use in both motor vehicles and aircraft must comply with all of the applicable requirements specified in section S5 and with the additional requirement specified in S8.1 and S8.2.

S8.1 Installation instructions. [Each child restraint system manufactured for use in aircraft shall be accompanied by printed instructions in English that provide a step-by-step procedure, including diagrams, for installing the system in aircraft passenger seats, securing a child in the system when it is installed in aircraft, and adjusting the system to fit the child. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)]**

[S8.2 Inversion test. When tested in accordance with S8.2.1 through S8.2.5, each child restraint system manufactured for use in aircraft shall meet the requirements of S8.2.1 through S8.2.6. The manufacturer may, at its options, use any seat which is a representative aircraft passenger seat within the meaning of S4. Each system shall meet the requirements at each of the restraint's seat back angle adjustment positions and restraint belt routing positions, when the restraint is oriented in the direction recommended by the manufacturer (e.g., facing forward, rearward or laterally) pursuant to S8.1, and tested with the test dummy specified in S7. If the manufacturer recommendations do not include instructions for orienting the restraint in aircraft when the restraint seat back angle is adjusted to any position, position the restraint on the aircraft seat by following the instructions (provided in accordance with S5.6) for orienting the restraint in motor vehicles. **(57 F.R. 41423—September 10, 1992. Effective: March 9, 1993)]**

S8.2.1 A representative aircraft passenger seat shall be positioned and adjusted so that its horizontal and vertical orientation and its seat back angle are the same as shown in Figure 6.

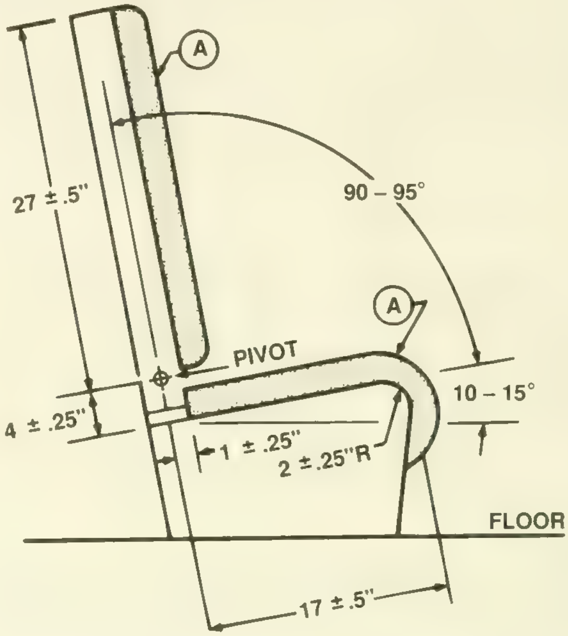


Figure 6—Simulated Aircraft Passenger Seat

"A" represents a 2- to 3-inch thick polyurethane foam pad, 1.5–2.0 pounds per cubic foot density, over 0.020-inch-thick aluminum pan, and covered by 12- to 14-ounce marine canvas. The sheet aluminum pan is 20 inches wide and supported on each side by a rigid structure. The seat back is a rectangular frame covered with the aluminum sheet and weighing between 14 and 15 pounds, with a center of mass 13 to 16 inches above the seat pivot axis. The mass moment of inertia of the seat back about the seat pivot axis is between 195 and 220 ounce-inch-second². The seat back is free to fold forward about the pivot, but a stop prevents rearward motion. The passenger safety belt anchor points are spaced 21 to 22 inches apart and are located in line with the seat pivot axis.

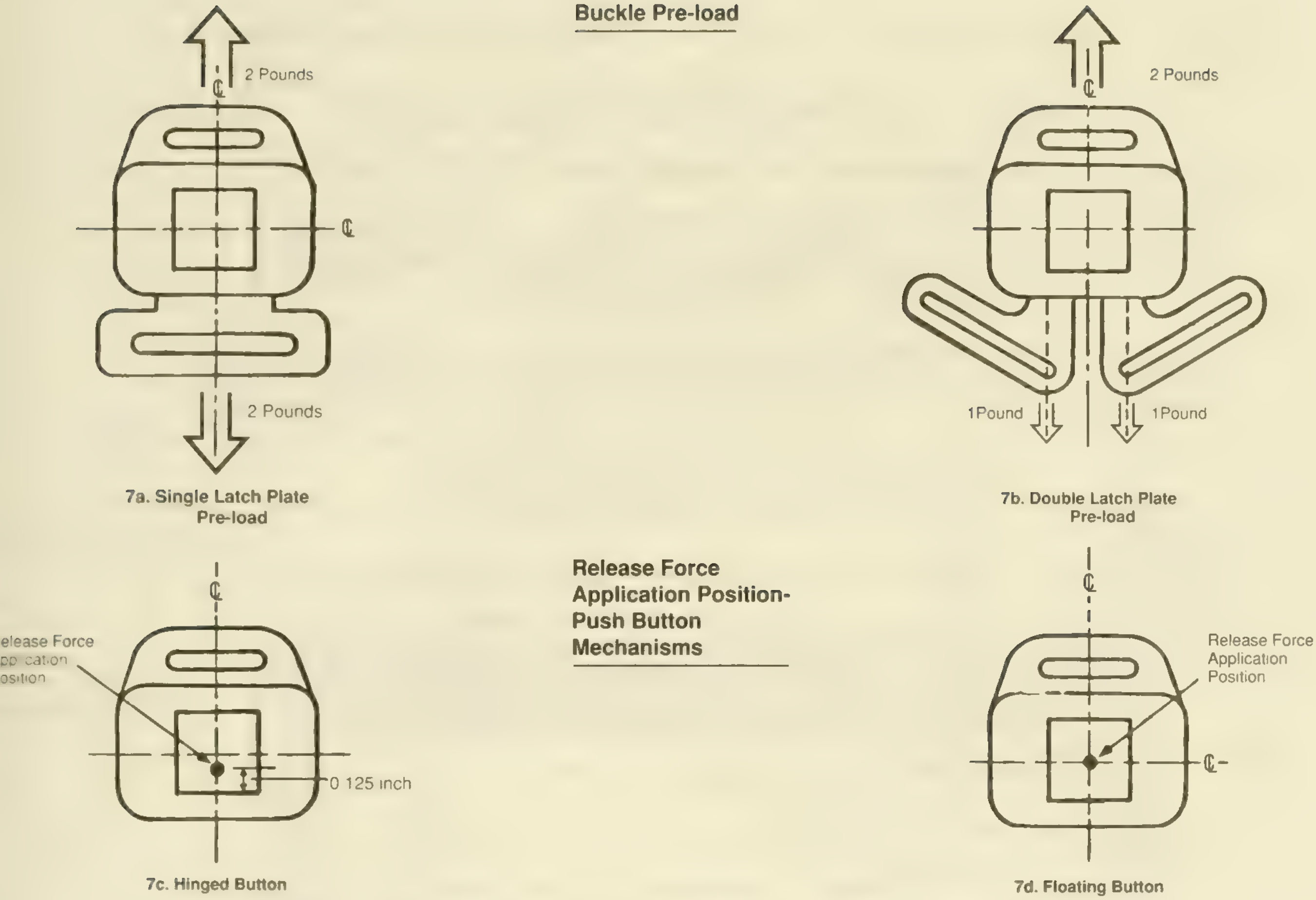


Figure 7—Pre-impact Buckle Release Force Test Set-up

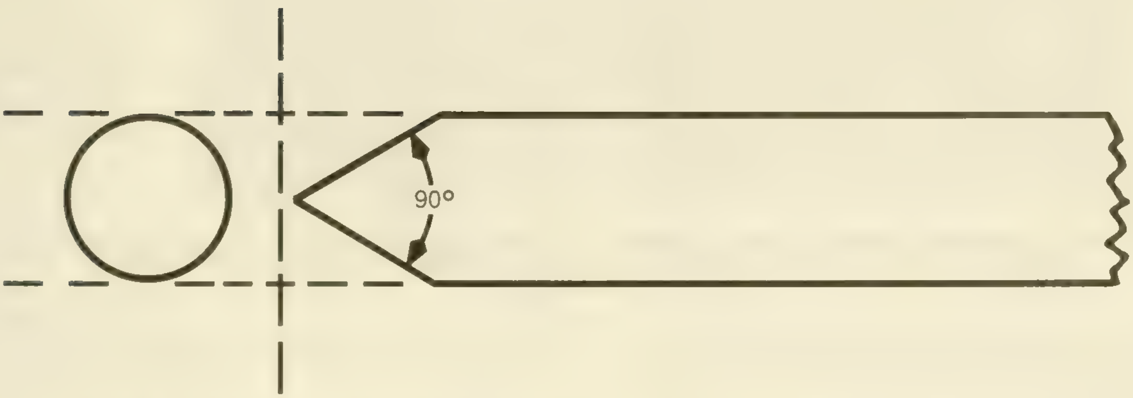


Figure 8—Release Force Application Device—Push Button Release Buckles

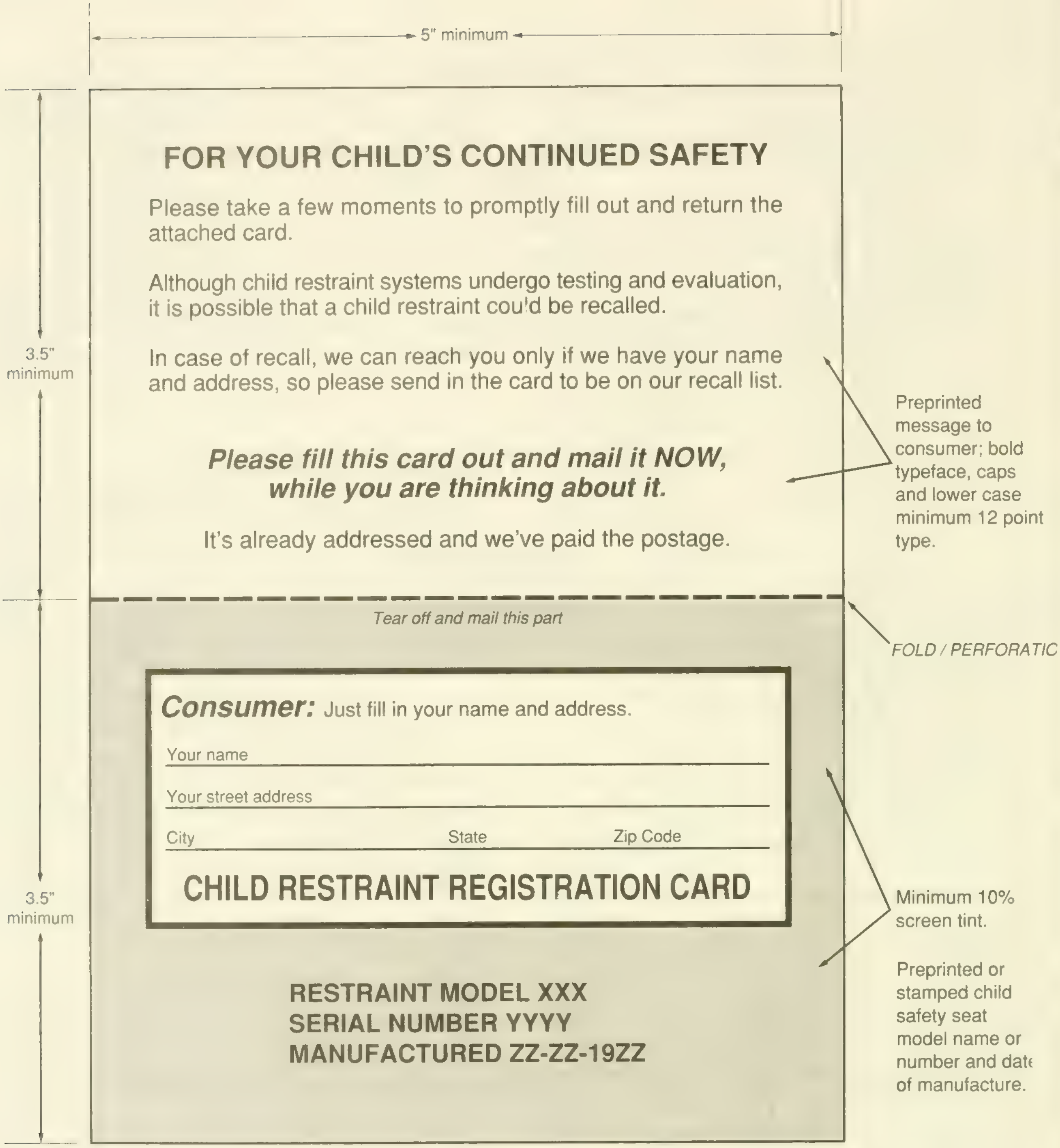


Figure 9—Registration Form for Child Systems—Product Identification Number and Purchaser Information Side.

[(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]

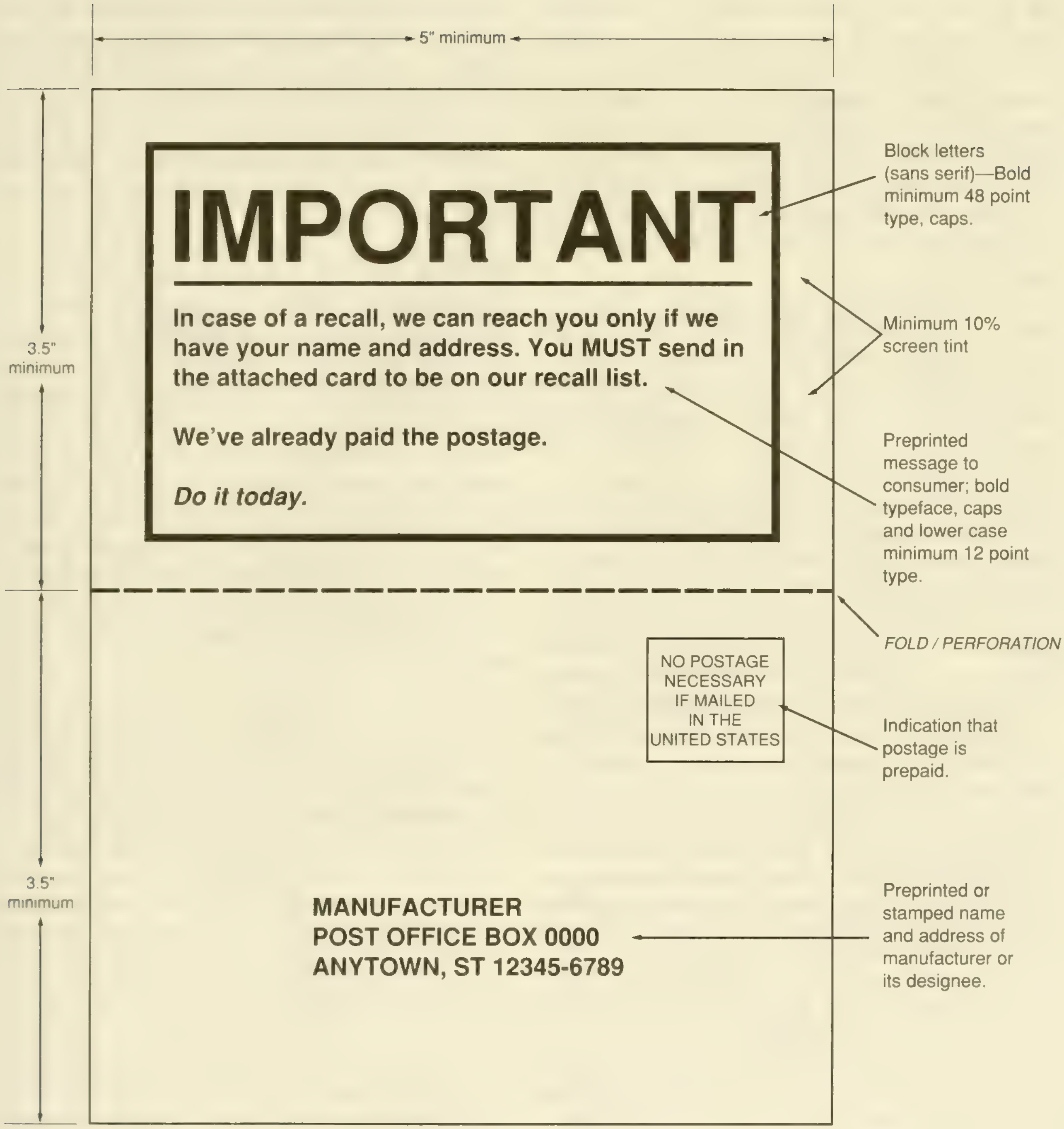


Figure 10—Registration Form for Child Restraint Systems—Address Side.

[(57 F.R. 41428—September 10, 1992. Effective: March 9, 1993)]

S8.2.2 The child restraint system shall be attached to the representative aircraft passenger seat using, at the manufacturer's options, any Federal Aviation Administration approved aircraft safety belt, according to the restraint manufacturer's instructions for attaching the restraint to an aircraft seat. No supplementary anchorage belts or tether straps may be attached; however, Federal Aviation Administration approved safety belt extensions may be used.

S8.2.3 In accordance with S6.1.2.3.1 through S6.1.2.3.3, place in the child restraint any dummy specified in S7 for testing systems for use by children of the heights and weights for which the system is recommended in accordance with S5.5 and S8.1.

S8.2.4 If provided, shoulder and pelvic belts that directly restrain the dummy shall be adjusted in accordance with S6.1.2.4.

S8.2.5 The combination of representative aircraft passenger seat, child restraint and test dummy shall be rotated forward around a horizontal axis which is contained in the median transverse vertical plane of the seating surface portion of the aircraft seat and is located one inch below the bottom of the seat frame, at a speed of 35 to 45 degrees per second, to an angle of 180 degrees. The rotation shall be stopped when it reaches that angle and the seat shall be held in this position for three seconds. The child restraint shall not fall out of the aircraft safety belt, nor shall the test dummy fall out of the child restraint at any time during the rotation or the three second period. The specified rate of rotation shall be attained in not less than one-half second, and not more than one second, and the rotating combination shall be brought to a stop in not less than one half second and not more than one second.

S8.2.6 Repeat the procedures set forth in S8.2.1 through S8.2.4. The combination of the representative aircraft passenger seat, child restraint, and test dummy shall be rotated sideways around a horizontal axis which is contained in the median longitudinal vertical plane of the seating surface portion of the aircraft seat and is located one inch below the bottom of the seat frame, at a speed of 35 to 45 degrees per second, to an angle of 180 degrees. The rotation shall be stopped when it reaches that angle and the seat shall be held in this position for three seconds. The child restraint shall not fall out of the aircraft safety belt, nor shall the test dummy fall out of the child restraint at any time during the rotation or the three second period. The specified rate of rotation shall be attained in not less than one half second and not more than one second, and the rotating combination shall be brought to a stop in not less than one half second and not more than one second.

44 F.R. 72131
December 13, 1979

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Door Strength—Passenger Cars

(Docket No. 2–6; Notice No. 3)

The purpose of this amendment to §571.21 of Title 49, Code of Federal Regulations, is to add a new motor vehicle safety standard that sets minimum strength requirements for side doors of passenger cars. The standard differs in only a few details from the notice of proposed rulemaking published on April 23, 1970 (35 F.R. 6512).

As noted in the proposal of April 23, the percentage of dangerous and fatal injuries in side collisions increases sharply as a maximum depth of penetration increases. With this in mind, the notice of proposed rulemaking stressed the need for a door that offers substantal resistance to intrusion as soon as an object strikes it. The proposal required a door to provide an average crush resistance of 2,500 pounds during the first 6 inches of crush. One comment stated that equivalent protection can be provided by structures further to the interior of the door and that the proper measure of protection is the force needed to deflect the inner door panel rather than that needed to deflect the outer panel. Although inboard mounted structures may be effective in preventing intrusion if the door has a large cross section, with a correspondingly large distance between the protective structure and the inner panel, the standard as issued reflects the determination that doors afford the greatest protection if the crush resisting elements are as close to the outer panel as possible. It follows from this determination that the surface whose crush is to be measured must be the outer panel rather than the inner one. The value specified for the initial crush resistance has, however, been reduced from 2,500 pounds to 2,250 pounds, a value that has been determined to be more appropriate, particularly for lighter vehicles.

Two comments suggested that the crush distance should be the distance traveled by the loading device after an initial outer panel distortion caused by a "pre-load." This suggestion is without merit, in that it would permit use of needlessly light outer panel materials and thereby diminish the distance between the protective elements of the door and the occupants.

The comments revealed a considerable difference of opinion concerning the value and validity of the concept of "equivalent crush resistance." The equivalent crush resistance was to be derived by adding ¼ (3000–W) to the average force required to crush the door 12 inches. It had been thought that the resulting bias against heavier vehicles was necessary in that their greater mass would cause them to move sideways less in a collision than lighter vehicles, with more of the impacting force being absorbed by the door. Recent studies, however, show that occupants of heavier vehicles involved in side collisions generally suffer a lower proportion of serious injuries and fatalities than persons in lighter vehicles. In light of these studies and other information, the standard retains the basic crush resistance requirement, but deletes the weight correction factor. Since it is no longer appropriate to use the term "equivalent crush resistance," in its place the standard employs the phrase "intermediate crush resistance." The slightly lower figure of 3,500 pounds has been substituted for the 3,750 pound force proposed in the notice. The effect of the change is to increase slightly the crush resistance required for vehicles having curb weight less than 1,800 pounds, and to decrease it slightly for vehicles weighing more than 1,800 pounds.

Similar reasoning lies behind a change in the requirement for peak crush resistance. The available information does not support a peak crush requirement that increases indefinitely with increasing vehicle curb weight. The standard therefore sets a ceiling of 7,000 pounds to the requirement that the door have a peak crush resistance of twice the vehicle's curb weight. In effect, the requirement is unchanged from the proposal for vehicles weighing less than 3,500 pounds, and is diminished for vehicles exceeding that weight.

Several comments suggested that the vehicle should be tested with all seats in place, since the seats may provide protection against intrusion in side impacts. It is recognized that proper seat design can contribute to occupant safety. The retention of the seat would, however, introduce a variable into the test procedue whose bearing on safety is not objectively measurable at this time. For this reason, the standard adopts the proposed requirement that the vehicle be tested with its seats removed.

It was suggested that the location of force application should be changed. The location has been designated to approximate the weakest section of that part of the door structure likely to be struck by another vehicle. The area designated has been found the most approriate for the bulk of the automobile population.

Effective date: January 1, 1973.

The majority of comments stated that an effective date of September 1, 1971, as initially proposed, would not be feasible. After evaluation of the comments and other information, it has been determined that the structural changes required by the standard will be such that many manufacturers woud be unable to meet the standard if the September 1, 1971, effective date were retained. It has been decided that there is good cause for establishing an effective date more than 1 year after issuance of the rule.

In consideration of the above, Standard No. 214 is adopted as set forth below.

Issued on October 22, 1970.

Douglas W. Toms,
Director.

35 F.R. 16801
October 30, 1970

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Door Strength

(Docket No. 2-6; Notice No. 6)

ACTION: Final Rule.

SUMMARY: The purpose of this notice is to amend Safety Standard No. 214, *Side Door Strength,* to allow manufacturers the option of leaving the seats in a vehicle while its ability to resist external forces pressing inward on its door is tested. This amendment was proposed by the NHTSA in response to a petition for rulemaking from Volvo of America Corporation (44 FR 33444, June 11, 1979). The change is intended to give manufacturers broader design capabilities for improving the safety of vehicle occupants involved in side impact collisions. The performance levels for the alternative requirements are lower than those specified in the notice of proposed rulemaking, due to the agency's consideration of public comments on that notice.

EFFECTIVE DATE: The amendment made by this notice becomes effective upon publication in the FEDERAL REGISTER.

ADDRESSES: Any petitions for reconsideration of this rule should refer to the docket number and notice number and be submitted to the National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

FOR FURTHER INFORMATION CONTACT:

Mr. William Brubaker, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration. (202-426-2242).

SUPPLEMENTARY INFORMATION:

Safety Standard No. 214, *Side Door Strength* (49 CFR 571.214), specifies performance requirements for the side doors of passenger cars to minimize the life-threatening forces caused by intrusion of objects such as other vehicles, poles and tree trunks into the occupant compartment in side-impact accidents. The standard currently specifies three static crush tests (initial, intermediate and peak) to measure the crush resistance of the side doors. The basis for these tests is that early studies concerning side impact protection demonstrated that, in fatal side collisions, most occupants die because of the door structures collapsing inward on them. The static crush tests are intended to ensure that there are strong door structures to limit this intrusion. Under the peak crush test of the standard, the vehicle door may not be deformed more than 18 inches inward when the door is subjected to a force of 7,000 pounds, or two times the curb weight of the vehicle, whichever, is less.

The existing test procedures of the standard specify that the vehicle seats are to be removed during the crush tests. Although it was recognized when the standard was originally promulgated that proper seat design can also reduce the amount of intrusion of side door structures into the occupant compartment, it was determined that this standard should measure the integrity of door structures alone.

Manufacturers have generally incorporated various types of beams in the outer door panels to provide crush resistance in compliance with the standard. Last year, however, Volvo of America Corporation petitioned the agency to allow vehicle seats to remain in the automobile during the crush resistance tests. Volvo stated that it has developed an advanced side impact protection system that incorporates the vehicle seats as an essential component and dispenses with door beams. Test data indicate that the Volvo design provides side impact protection that is equal to or greater than that provided by current production designs.

In response to Volvo's petition, the agency issued a notice of proposed rulemaking to allow manufacturers to adopt this option (44 FR 33444, June 11, 1979). The notice stated that manufacturers should be encouraged to develop innovative designs for improving side impact protection, particularly designs that will improve vehicle fuel economy because of reduced weight. Although not included in Volvo's petition, the proposal specified higher crush resistance levels for vehicles tested with their seats intact (a 16,000-pound peak force).

The criteria were set at levels intended to assure an equivalent or greater level of protection compared to the existing requirements. Agency data show that the seats of some current models contribute 4 to 5 thousand pounds of crush resistance in addition to the crush resistance provided by the doors themselves. Therefore, the higher performance levels were proposed to ensure that the current level of crush resistance that is being obtained by strong door beams will not be degraded.

Nearly all of the twelve comments received in response to the notice supported the proposal to give manufacturers the option of testing with seats installed in the vehicle. A majority of the commenters objected to the higher crush resistance levels for the alternative procedure, however. Only Volkswagen Corporation stated that the standard should not be amended to allow the option. Following is a discussion of these comments.

The Insurance Institute for Highway Safety stated that the proposed amendment would give auto manufacturers a broader range of design alternatives than they currently have to reduce the likelihood of injuries to occupants of vehicles struck in the side. Most commenters made similar statements. Mercedes-Benz of North America noted that manufacturers would be afforded greater latitude in selecting designs to comply with the standard, without sacrificing occupancy protection, and at the same time could reduce vehicle weight.

While agreeing with the concept of the proposed alternative requirement, a large number of commenters felt the proposed performance criteria were too stringent. Peugeot, as well as the Motor Vehicle Manufacturers Association, stated that the current performance levels should apply whether the seats are left in the vehicle during testing or not. American Motors Corporation argued that the proposed crush resistance levels for the alternative procedure are significantly more stringent than existing 214 requirements, and that the NHTSA has not identified any safety need to justify this higher level of performance.

The agency does not agree that the performance levels of the standard should be the same whether the seats are left in the vehicle or are removed. As noted in the proposal, current vehicle seat designs often provide four to five thousand pounds of additional crush resistance above that required by the standard. Further, the standard was originally only intended to test the crush resistance of the doors alone. Therefore, if the performance criteria were the same with and without the seats in the vehicle during the test, manufacturers could reduce the current protection provided by their doors without upgrading their vehicles in other areas. Given the large number of fatalities in side impact accidents, the agency is very concerned that such a degradation of vehicle performance not occur under the alternative test procedure. Therefore, it is the agency's position that there is a substantial safety need to assure that the level of protection provided under the alternative procedure is equivalent to or greater than that provided under the existing test procedure.

Several commenters argued that the data and test results relied upon by the agency to establish the crush resistance levels for the alternative procedure are too limited, and that research should be expanded to include tests of other models prior to establishing the criteria. General Motors stated, for example, that the two vehicles used in NHTSA tests may not be representative of other vehicle designs which could exhibit differing door-to-seat interaction.

The agency disagrees with these contentions. Volvo and Ford Motor Company provided the NHTSA with data from tests they conducted with seats and without seats installed in some of their production vehicles. The agency conducted comparable tests on a Plymouth Volare, and the tests included both bench seats and bucket seats. This and other information substantiate that vehicle seats can and do provide much additional resistance to side door intrusion. These data demonstrate that crush resistance levels should be higher if vehicle seats are left installed during the testing in order to maintain the level of protection currently being provided.

Ford Motor Company argued that the proposed higher performance levels were based on limited tests of current production models, and that the higher performance results achieved in those tests represent built-in reserves by manufacturers above the minimum performance requirements of the standard. Ford stated that the crush resistance criteria of the proposed alternative should not be set at this upper level of performance. Other commenters, including Volvo, also argued that the proposed criteria were too high to allow for production variances. General Motors stated that the proposal does not really remove inhibitions to design innovation due to the increased performance requirements of the proposed alternative procedure. Finally, Rolls-Royce Motors urged that the performance criteria be set low enough that the potential weight savings offered by the proposal can be realized in practice.

After considering these comments, the agency has determined that the crush resistance levels for vehicles tested with their seats intact should be somewhat lower than those specified in the proposal. This will allow for production variances and enable manufacturers to build in a margin of protection above the minimum performance requirements specified in the standard.

In its comments, Volvo Corporation suggested that the intermediate crush resistance level should be set at 4,375 pounds (the proposal specified 7,000 pounds) and that peak crush resistance should be set at 12,000 pounds (the proposal specified 16,000 pounds). Volvo stated that tests of its current production cars that have door beams indicate a spread in intermediate crush resistance of approximately 2,000 pounds. The company noted that an intermediate crush resistance level that is twenty-five percent above the existing requirement would compensate for the addition of seats during testing and at the same time allow manufacturers a sufficient margin to comply with the standard. Volvo also stated that since the seats of some current cars add approximately 4,000 to 5,000 pounds of peak of crush resistance, this should be the amount of increase above the existing requirements, i.e., from 7,000 pounds to 12,000 pounds. Although Volvo's preliminary testing of its advanced side impact protection system indicates that the 16,000-pound requirement could be met, the company feels that the margin is not sufficient to allow for production variances.

The agency agrees with Volvo's suggested crush resistance levels, since they should ensure that the level of protection provided under the alternative requirement is at least equivalent to that provided currently. Therefore, these criteria are adopted in this amendment. While it is encouraging that Volvo's advanced system can meet the 16,000-pound peak force specified in the proposal, this may be too high for other manufacturers at the present time, and the agency's primary concern in allowing the alternative test procedure is to avoid any degradation of the protection being provided under the current requirement. The high performance of Volvo's advanced system will be considered very seriously, however, during the planned rulemaking to upgrade side impact protection (an advance notice of proposed rulemaking concerning improving side impact protection was recently issued: 44 FR 70204, December 6, 1979).

As noted above, data indicate that current seat designs contribute approximately 5,000 pounds to the crush resistance capacity of vehicle side structures. Therefore, the 12,000-pound peak force level specified in this amendment will assure the side impact protection is not degraded, but will also allow manufacturers to develop new designs to meet the requirements. As demonstrated by Volvo, manufacturers will be able to develop new side structures and seat designs that will provide over 12,000 pounds of crush resistance without the use of heavy door beams.

Mercedes-Benz of North America commented that the "initial" crush resistance requirement of the proposed alternative should be deleted (paragraph S3.2.1 of the proposal). Mercedes argued that the three-stage static crush tests assign too much significance to the first stage (initial crush resistance), since door reinforcement is necessary primarily to ensure compliance with this initial test. According to Mercedes, the initial resistance is achieved within the first six inches of crush depth (measured at the outer surface of the door), but that this is not more than one-ninth of the total energy absorption when testing without the vehicle seats. When testing with the seats, according to Mercedes, the percentage of energy absorption at the outer surface of the door panel is meaningless with respect to the total energy management and occupant protection.

The agency does not agree with this rationale. The initial crush resistance stage is necessary to

ensure that vehicle doors have at least a minimum of structural integrity. This is particularly important because of the risk of occupant ejection if door hinges and latches separate during an accident, allowing the door to fly open. Although seat design can ameliorate intrusion into the occupant compartment to a certain extent, it is important to coordinate door structure and seat design to achieve the optimum occupant protection. Because of the initial crush resistance requirements, manufacturers may not be able to delete door beams altogether in some models. However, manufacturers will be able to use much lighter beams than are currently being used, without a reduction in overall performance.

Several commenters addressed the seat location specified in the proposed alternative requirement. The proposal provided that vehicles must be able to meet the specified crush resistance levels with the vehicle seats located in any position and at any seat back angle in which they are designed to be adjusted. Volvo's petition had requested that the mid, horizontal seat adjustment position be specified. Volkswagen of America stated that the new proposed test procedure, with the seat in any position of its adjustment range, potentially increases the test effort. Volkswagen argued that manufacturers would have the obligation to determine, by a test series, the most adverse test positions of the seat, and that this would be much more costly than the existing requirement.

While it may be true that requiring a vehicle to comply with the seat in any position to which it can be adjusted will require more effort by manufacturers, the agency has determined that this is a necessary aspect of the new procedure. If the vehicle seats are to be used as an integral part of the side impact protection system, it is important that the protection is provided regardless of where the seat is located along its adjustment range.

General Motors stated in its comments that it is reasonable to require demonstrated performance to assure that the occupant seat will assist in limiting side crush in any normal driving position. However, General Motors stated that the same rationale should not apply to seat back angle, and that the normal riding or driving angle established by the manufacturer should be used for compliance purposes. Volvo's comments agreed with General Motors regarding seat back angle.

The agency does not see a distinction between horizontal seat adjustment and seat back angle adjustment. If a particular seat is designed to be adjusted through a range of seat back angles, the vehicle should be able to comply with the requirement of the standard with the seat back at any of its adjustment angles, for the same reasons as noted above for horizontal adjustment. Further, the agency does not believe that the cost of testing will be substantially different if manufacturers are responsible for compliance with the seat in any adjustment position. Manufacturers, in some cases, may be able to determine the "worst case" position for seat location by engineering judgment and analysis prior to testing the vehicle. If a manufacturer has designed the vehicle seat to be an integral part of the side impact protection system, the manufacturer will likely know which position provides the most support and resistance to intrusion (and which provides the least support).

Of the commenters on the proposal, only Volkswagen Corporation was opposed to the proposed alternative test procedure. Volkswagen stated that the proposed requirement is not in keeping with the original purpose of the standard—to prevent intrusion. The company argued that there is a potential for reduced occupant protection in the case of oblique angle or "side-swipe" crashes since a vehicle with a door structure of inferior strength, as compared to current designs, runs the possible risk of door destruction or separation. Volkswagen noted that this could expose vehicle occupants to the risk of ejection.

While the agency shares Volkswagen's concern that the occupant protection being afforded by current vehicle doors not be lessened, it does not believe that the optional test procedure will result in reduced performance. The higher crush resistance requirements for vehicles tested with their seats installed should ensure that the overall protection currently provided is maintained. Moreover, since the initial crush resistance stage is included in the alternative procedure, in spite of comments that it should be deleted, door structures will have to maintain a certain amount of structural integrity. The 2,250-pound initial crush resistance level will ensure that door hinges and latches are of sufficient strength to preclude separation in most cases. Therefore, the agency

does not believe that the alternative procedure will lead to increased ejections. The agency does believe, however, that both the current requirement and the alternative requirement should be upgraded. As noted earlier, the agency is presently involved in rulemaking regarding such an upgrade of the standard. The agency does not agree with Volkswagen's contention that the proposed test procedure is not aligned with the original purpose of the standard, since it has been demonstrated that effective seat design can substantially reduce intrusion into the occupant compartment.

The notice proposing this amendment specifically requested comments concerning the effect modifications to side door structures (i.e., lighter door beams or deletion of door beams, altogether) might have on vehicle integrity in frontal and front-angular crashes. In response to this request, Rolls-Royce Motors commented that the door beams used in its vehicles have had a negligible effect on vehicle integrity in frontal crashes. The company added that the requirements of Safety Standard No. 208, *Occupant Crash Protection,* will ensure that manufacturers maintain sufficient structural integrity for front-end crashes even with sophisticated vehicle designs achieving the maximum savings in weight.

American Motors Corporation also stated that the various safety standards requiring frontal impact tests will maintain frontal integrity regardless of modifications to side door structures. Volvo provided data from off-set crash tests involving vehicles both with and without door beams. Both vehicles showed deformation characteristics (damage to vehicle structure) that are within the variances found for current production cars. In light of this information and the fact that there are other safety standards to ensure vehicle integrity in frontal impacts, the agency has concluded that the alternative test procedure set forth in this amendment will have no adverse effect on frontal occupant crash protection.

The agency has reviewed this amendment in accordance with the specifications of Executive Order 12044, "Improving Government Regulations," and the Departmental guidelines implementing that order and determined it has no significant environmental impact and that its economic impact is so minimal as not to require a regulatory evaluation. The amendment will merely provide manufacturers an alternative test procedure for determining compliance with an existing standard. For this reason, also, the agency has determined that an immediate effective date for this amendment is in order.

The engineer and lawyer primarily responsible for the development of this rule are William Brubaker and Hugh Oates, respectively.

In consideration of the foregoing, Safety Standard No. 214 (49 CFR 571.241) is amended as set forth below.

Section S3 (S3 through S3.3) is amended to read as follows and the first sentence of subparagraph S4(a) is deleted.

§ 571.214 Standard No. 214; Side door strength.

* * * * *

S3 *Requirements.* Each vehicle shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2 when any of its side doors that can be used for occupant egress are tested according to S4.

S3.1 With any seats that may affect load upon or deflection of the side of the vehicle removed from the vehicle, each vehicle must be able to meet the requirements of S3.1.1 through S3.1.3.

S3.1.1 *Initial Crush Resistance.* The initial crush resistance shall not be less than 2,250 pounds.

S3.1.2 *Intermediate Crush Resistance.* The intermediate crush resistance shall not be less than 3,500 pounds.

S3.1.3 *Peak Crush Resistance.* The peak crush resistance shall not be less than two times the curb weight of the vehicle or 7,000 pounds, whichever is less.

S3.2 With seats installed in the vehicle, and located in any horizontal or vertical position to which they can be adjusted and at any seat back angle to which they can be adjusted, each vehicle must be able to meet the requirements of S3.2.1 through S3.2.2.

S3.2.1 *Initial Crush Resistance.* The initial crush resistance shall not be less than 2,250 pounds.

S3.2.2 *Intermediate Crush Resistance.* The intermediate crush resistance shall not be less than 4,375 pounds.

S3.2.3 *Peak Crush Resistance.* The peak crush resistance shall not be less than three and one half times the curb weight of the vehicle or 12,000 pounds, whichever is less.

Issued on March 11, 1980.

Joan Claybrook
Administrator

45 F.R. 17015
March 17, 1980

FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 214
Side Impact Protection

Docket No. 88-06; Notice 8
RIN 2127-AB86

ACTION: Final rule.

SUMMARY: This notice amends Standard No. 214, *Side Door Strength*, to upgrade its test procedures and performance requirements for passenger cars. For many years, the standard has measured performance statically in terms of the ability of each door to resist a piston pressing a rigid steel cylinder inward against the door. These amendments require in addition that each passenger car must protect its occupants in a full-scale dynamic crash test in which the car is struck on either side by a moving deformable barrier simulating another vehicle. Instrumented test dummies are positioned in the target car to measure the potential for injuries to an occupant's thorax and pelvis.

Two alternative compliance schedules are established, the choice of which is at the option of the manufacturer. Under one, the requirement will be phased-in by an annually increasing percentage of each manufacturer's production over a three-year period beginning on September 1, 1993, with full implementation effective September 1, 1996. Under the other, no compliance will be required during the production year beginning September 1, 1993, but full implementation will be required effective September 1, 1994. In separate notices in today's *Federal Register*, the agency is establishing specifications for the new side impact test dummy and moving deformable barrier, as well as reporting requirements related to compliance with the phase-in of the new side impact requirements.

EFFECTIVE DATE: The amendments made by this rule to the text of the Code of Federal Regulations are effective NOVEMBER 29, 1990.

Percent compliance required during production Year Beginning

	9/1/93	9/1/94	9/1/95	9/1/96
Schedule one	10%	25%	40%	100%
Schedule two	0%	100%		

SUPPLEMENTARY INFORMATION:

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I. Background

NHTSA's current standard for side impact protection is Federal Motor Vehicle Safety Standard No. 214, Side Door Strength (49 CFR 571.214). The standard specifies performance requirements for each side door in a passenger car, to mitigate occupant injuries in side impacts by reducing the extent to which the side structure of a car is pushed into the passenger compartment during a side impact. The standard requires each door to resist crush forces that are applied by a piston pressing a steel cylinder inward against the door's outside surface in a laboratory test. The standard does not attempt to regulate directly the level of crash forces on an occupant who strikes or is struck by the car's interior during a side impact crash. Since the standard became effective on January 1, 1973, vehicle manufacturers have generally chosen to meet its performance requirements by reinforcing the side doors with metal beams.

NHTSA's analysis of real-world crash data has shown that the strengthening of the side doors with metal beams is indeed effective, but primarily in single car side impacts. The agency's November 1982 study, "An Evaluation of Side Structure Improvements in Response to Federal Motor Vehicle Safety Standard 214" (DOT HS 806-314), estimated that 480 lives have been saved and 9,500 fewer hospitalizations have occurred per year as a result of the standard. The study also found that while single vehicle occupant fatalities were reduced by 14 percent, the standard had little effect on reducing fatalities in multi-car collisions.

Because of the large number of fatalities and injuries which continue to result from side impact crashes, the agency initiated a research program to upgrade the current standard. This effort focused primarily on thoracic protection, since data indicate that contact between the thorax and the side interior is a major source of serious injuries and fatalities.

The agency has conducted research on improved side impact protection since the late 1970's. Much information has been acquired not only from agency research but also from industry and research groups throughout the world. The agency has presented its findings and has communicated with groups in numerous meetings and conferences such as Society for Automotive Engineers (SAE), Stapp Car Crash Conferences, Experimental Safety Vehicle Conferences (ESV), International Research Council on Biokinetics of Impacts (IRCOBI), and NHTSA sponsored public meetings (1979 and 1986). NHTSA has sought to address pertinent aspects of the side impact protection issue, which cover the test procedure, side impact dummy, injury criteria, and characteristics of those crashes as they occur in the real world.

Based on that research, on January 27, 1988, NHTSA published in the *Federal Register* (53 FR 2240), a notice of proposed rulemaking (NPRM) to upgrade the standard by using a test procedure which simulates a two-vehicle side crash representative of an injurious side crash. The proposed test uses a moving deformable barrier (MDB), weighing approximately 3,000 pounds, to represent a vehicle which is traveling at 30 mph and strikes the side of another vehicle which is traveling at 15 mph. To measure the magnitude of the threat of injury resulting from the side impact collision, the agency proposed to use a specially developed side impact dummy (SID). NHTSA proposed to use two of these dummies in a test, with one being placed on the front outboard seat and the other on the rear outboard seat, on the struck side of the car. The agency proposed specifications for the SID in a separate NPRM issued at the same time as the NPRM to upgrade Standard No. 214 (53 FR 2254).

NHTSA stated that its side impact proposal would complement the existing standard, which is primarily effective in single vehicle side impact accidents, by providing additional protection in multi-vehicle side impacts. As indicated above, the existing standard does not directly assess the injury probabilities associated with different vehicle designs in a specific impact, but instead uses the ability of the side doors to resist intrusion as a surrogate measure of the potential for injury.

In the NPRM, the agency proposed to establish specific performance criteria which must be met to reduce the possibility of thoracic side impact injuries without increasing harm to the pelvis. The notice proposed to require passenger cars not to exceed specified performance limits for the thorax and the pelvis. For the thorax, the proposed performance limit used an injury criterion known as the Thoracic Trauma Index (dummy) or TTI(d). This injury criterion represents the average of peak acceleration values measured on the lower spine and the greater of the acceleration values of the upper and lower ribs of the test dummy. NHTSA requested comments on the appropriateness of setting a TTI(d) limit ranging from 80 to 115 g's (where "g" is defined as the acceleration due to gravity). In addition, the notice requested comments on the appropriateness of setting limits, ranging from 130 to 190 g's, on the peak acceleration that the pelvis should experience during the impact. Finally, to reduce the possibility of occupant ejection, the agency proposed to require

that each door in the struck vehicle remain closed during the crash test.

To provide manufacturers with sufficient leadtime to design their passenger cars to meet the proposed performance requirements, NHTSA proposed to phase-in the new requirements in accordance with the following implementation schedule:

10 percent of each manufacturer's cars manufactured during the first full production year (September 1 to August 31) beginning more than 24 months after the issuance of the final rule;

25 percent of each manufacturer's cars manufactured during the second full year beginning after that 24-month period;

40 percent of each manufacturer's cars manufactured during the third full year after that 24-month period; and

All cars manufactured on or after the beginning of the fourth full year after that 24-month period.

In addition to issuing the January 1988 NPRM to improve thoracic protection in passenger car side impacts, NHTSA has also, during the past several years, been involved in several other efforts to improve side impact protection. These efforts cover both passenger cars and light trucks, vans and multipurpose passenger vehicles (MPV's).

On August 19, 1988, the agency published in the *Federal Register* (53 FR 31712) an advance notice of proposed rulemaking (ANPRM) concerning requirements for passenger cars intended to reduce the risk of head and neck injuries and ejections, in side impact crashes between vehicles and in other crashes where the side protection of the vehicle is a relevant factor. The ANPRM also sought comments on whether additional requirements should be considered to address side impacts with poles and trees.

NHTSA's efforts to improve side impact protection for light trucks, vans and MPV's (collectively referred to as "LTV's") largely correspond to its efforts for passenger cars. On August 19, 1988, the agency published in the *Federal Register* (53 FR 31716) an ANPRM regarding possible requirements for LTV's in each of the areas where requirements have been established, or are under consideration, for passenger cars. In summary, the ANPRM addressed: (1) extension to LTV's of Standard No. 214's existing requirements, i.e., measuring performance in terms of the ability of each door to resist a piston pressing a rigid steel cylinder inward against the door, (2) developing dynamic test procedures and performance requirements for LTV's, corresponding to those proposed in the January 1988 NPRM for passenger cars, and (3) developing requirements for LTV's intended to reduce the risk of head and neck injuries and ejections, corresponding to those addressed in the August 1988 ANPRM for passenger cars.

On December 22, 1989, NHTSA published in the *Federal Register* (54 FR 52826) an NPRM to extend the existing requirements of Standard No. 214 to LTV's. Of the various potential side impact requirements for LTV's that were addressed in the ANPRM, the agency was the furthest advanced in analyzing the extension of Standard No. 214's existing requirements to those vehicles. As indicated in the NPRM, NHTSA decided to go forward with rulemaking on that issue separately, since addressing all of the potential requirements together could result in unnecessary delays.

II. Public Comments on the January 1988 NPRM

NHTSA received comments from auto manufacturers, manufacturer organizations, consumer groups, insurance organizations, governmental organizations, international organizations, and private individuals. A brief summary of the most significant public comments is provided in this section. Subsequent portions of the preamble discuss the issues and present the agency's position and response to the public comments. The comments are discussed at greater length in those sections of the preamble. Because of the large number of public comments, NHTSA has provided, throughout the preamble, a representative sample of the comments made and the commenters who made them. Some of the comments relate to more than one issue. The agency analyzes and responds to the comments in more detail in its Final Regulatory Impact Analysis (FRIA), which is being issued along with this final rule.

Auto manufacturers unanimously opposed adoption of the proposed side impact requirements, challenging numerous aspects of the proposed performance requirements and test procedure. The auto manufacturers argued against adoption of the TTI(d) injury criterion. A number of manufacturers argued that TTI(d) cannot reliably predict thoracic injury risk in a crash because it lacks a biomechanical basis and is test-condition-dependent. Some manufacturers argued that TTI(d) is fundamentally flawed because it is acceleration-based and does not take thoracic compression into account. Several manufacturers argued that the use of TTI(d) could lead to designs which provide little or no safety benefit, or even degrade occupant safety by leading to the installation of padding that is overly stiff.

Numerous manufacturers argued that NHTSA should regulate side impact protection by means of component tests instead of a full scale crash test. Those commenters argued that component tests would be less expensive to conduct, could be utilized

early in the design stage of a vehicle, and would promote international harmonization.

Manufacturers also presented numerous objections to the proposed SID and MDB. The agency notes that while it proposed specifications for the MDB as part of its primary side impact NPRM, the MDB is covered in a separate notice for purposes of a final rule. Therefore, comments concerning the MDB are addressed in that notice. Similarly, comments on the NPRM concerning the SID are addressed in the SID final rule.

The Insurance Institute for Highway Safety (IIHS) stated that it strongly supports the agency's proposal, including specification of a full scale crash test and use of TTI(d). That commenter argued that the proposed amendment is an important and long overdue first step toward the larger goal of reducing all types of serious injuries in side impacts. The American Insurance Association stated that it supports NHTSA's efforts to improve side impact protection and urges promulgation and implementation of a final rule as quickly as possible.

The Center for Auto Safety and Public Citizen argued that the proposed requirements are not sufficiently stringent. Those commenters argued that NHTSA should have considered much more stringent alternatives, such as 60 degree impact angles, higher impact masses, and higher speeds. They also opposed the phase-in of the requirements.

On October 19, 1989, 19 members of the Senate Committee on Commerce, Science and Transportation sent a letter to Secretary Skinner urging action on the proposed side impact rulemaking. The letter noted the history of NHTSA's rulemaking on side impact protection, including issuance of the January 1988 NPRM. The letter stated:

> The full Senate recently passed, without opposition, legislation to require DOT rulemakings to improve side impact protection in passenger automobiles, and to extend that standard to minivans and light trucks. Mr. Secretary, this is a basic protection that should be afforded to all Americans, no matter what type of passenger vehicle they drive. NHTSA has gained valuable information over the past ten years on ways to improve side-impact protection. Further, the Department has the authority to require these improvements. We urge you to move forward now with a rulemaking to improve side-impact protection in passenger cars, light trucks and minivans.

III. Summary of the Final Rule

After a thorough review of the issue of side impact protection, including the comments on the NPRM and extensive studies, analyses, and data on the subject, NHTSA has decided to adopt a final rule based on its January 1988 proposal. NHTSA has decided to adopt TTI(d) limits of 85 g for 4-door cars and 90 g for 2-door cars. The pelvic acceleration limit is being set at 130 g for all cars. The requirements apply both to front and rear seats.

The performance levels established in this rule will achieve the optimum level of safety consistent with the statutory requirements for a safety standard. The levels will protect motor vehicle occupants against an unreasonable risk of injury in a side crash, while ensuring that the countermeasures necessary to achieve these levels are practicable. The agency expects considerable reductions in side impact fatalities and injuries to accrue because of this rule. As in other rulemaking evaluations, NHTSA will carefully monitor the benefits associated with this rule. Based on the performance of vehicles in laboratory crash tests, injury risk reductions determined from real-world crash data, improvements in available countermeasure technology and other factors, NHTSA will determine whether further rulemaking concerning side impact crash protection is warranted.

Two alternative compliance schedules are established, the choice of which is at the option of the manufacturer. Under the first schedule, each manufacturer will have to meet the new side impact performance requirements based on the following phase-in schedule:

10 percent of automobiles it manufactures during the 12 month period beginning September 1, 1993;

25 percent of automobiles it manufactures during the 12 month period beginning September 1, 1994;

40 percent of automobiles it manufactures during the 12 month period beginning September 1, 1995; and

All automobiles it manufactures on or after September 1, 1996.

Under the other schedule, no compliance will be required during the production year beginning September 1, 1993, but full implementation will be required effective September 1, 1994.

The rear seat requirements will not apply to cars which have rear seating areas that are so small that the SID dummy cannot be accommodated according to the specified positioning procedures. Only a very small number of sport cars are believed to be in this category. NHTSA has also decided not to apply the rear seat requirements to passenger cars with a wheelbase greater than 130 inches, since the rear seats are so far back from the MDB impact point that the side impact protection provided for those seating positions cannot appropriately be evaluated by the test procedure. The wheelbases of all production passenger cars are less than 130 inches, so this will only affect the rear seats of stretch limousines.

The bases for the agency's decision, and its response to the comments, are set forth below.

IV. The Safety Problem

NHTSA has separately analyzed the fatality and injury experience of passenger car occupants involved in side impact crashes. As discussed below, the data show that side impacts account for an average of almost 8,000 fatalities and more than 24,000 serious injuries, annually. These figures represent 30 percent of all passenger car occupant fatalities and 34 percent of the serious injuries that occur in passenger cars.

A. Fatalities.

NHTSA reviewed available crash data from 1978 to the present to determine the number of fatalities in side impact crashes. That review showed that side impacts resulted in an average of 7,730 fatalities per year over that period. The review further showed that, while side impact fatalities declined steadily from about 8,300 in 1978 to about 7,000 in 1982, they increased again to about 8,000 in 1986 and 7,900 in 1987. The percentage of side impact fatalities as a percentage of all occupant fatalities averaged 30.6 percent over this ten year period. That percentage remained fairly constant from 1978–1982, at about 29 percent, but has averaged 32 percent since 1983.

The agency also examined the data on fatal crashes to identify the first harmful event in fatal side impact accidents. Based on a review of data from crashes in 1982–1987, the agency found that 67 percent of all side impact fatalities result from vehicle-to-vehicle side impacts. Pole type impacts (poles, posts, fire hydrants, and trees) result in an additional 18 percent, and impacts with other fixed objects (boulders, culverts, embankments, bridge abutments, guard rails, etc.) together comprise approximately 10 percent of all side impact fatalities.

The agency also examined its data files to determine what areas of the body were being injured in side impacts. Since the Fatal Accident Reporting System (FARS) does not provide information on the body region injured or the injury contact points, the agency examined data from the 1979–1987 National Accident Sampling System (NASS) and the 1977–1979 National Crash Severity Study (NCSS) on fatalities in which the most severe damage to the fatality victim's vehicle was a left side or right side deformation. Only model year 1973 and later vehicles were included in this analysis, to ensure that the data reflected the effect of side door beams, which were required by NHTSA beginning January 1, 1973, and appeared in many cars prior to that date. The data show that, for all types of side impact accidents including occupant ejections, head injuries are the most frequent sources of side impact fatalities (45%), followed by chest (29%), neck/spine (11%), and abdominal injuries (9%).

While head injuries are the most prevalent cause of side impact fatalities, NHTSA is aware that those injuries are not significantly addressed by this final rule. This rulemaking addresses thoracic and pelvic injuries, which are a large percentage of side impact fatalities and injuries, because the agency is further along in developing countermeasures to protect these body regions than it is in developing means of protecting the head. The agency is addressing head protection in a separate rulemaking. On August 19, 1988, NHTSA published in the *Federal Register* (43 FR 31712) an advance notice of proposed rulemaking that addressed head protection.

The performance test set forth in today's final rule simulates a lateral impact on a flat surface without ejection or rollover. Injuries to the chest and abdomen from contacting side surfaces are the major injury categories in this type of side impact crash. About 26 percent of side impact fatalities are relevant to the new performance requirements. This percentage includes only those cases where the chest or abdomen contacting the side interior or side hardware/armrest is the most severe injury. The requirements should also help reduce head and other injuries resulting from ejections, since the requirement that all doors of a tested car remain closed during the crash test will reduce the possibility of ejection in an actual crash.

B. Injuries.

In addition to examining the data on side impact related fatalities, the agency also reviewed data on the number of injuries in non-fatal side impact crashes. NHTSA estimated the average number of injuries, by deformation location and the maximum Abbreviated Injury Scale (AIS) level per survivor occupant, that would have occurred in 1982–87 if all cars in the fleet were MY 1973 and later cars—that is, if they all had side door beams. (The Abbreviated Injury Scale is used to rank injuries by level of severity. An AIS 1 injury is a minor one, while an AIS 6 injury is one that is currently untreatable and fatal.) The total estimated number of AIS 3–5 injuries (serious to critical injuries) to passenger car occupants from all crash modes is about 68,600 annually, based on data from the 1982–87 NASS file. That analysis showed that side impacts resulted in a total of about 24,400 AIS 3–5 injuries annually, or 35.6 percent of all AIS 3–5 injuries. This percentage is slightly higher than the percentage of side impact fatalities (31.6 percent) in the same six years. The analysis also showed that the side interior and side hardware/armrests accounted for 53 percent of the maximum AIS 3–5 injuries to front seat occupants sitting near the struck side of the vehicle, and for 68 percent of the maximum AIS 3–5 injuries to rear seat occupants sitting near the struck side of the vehicle.

V. Performance Requirements

A. Thorax

1. TTI(d) Performance Criterion

To assess the probability of an injury to the thorax in a side impact, NHTSA developed a new injury measure called the Thoracic Trauma Index (TTI). The TTI is a formula which can be used to predict the probability of injury for persons of different ages and weights. It uses the age and weight of each test subject, along with the average of the lower thoracic spine and upper or lower rib accelerations. (For rib accelerations, the higher of the acceleration responses from the upper and lower ribs is used.)

The TTI was developed from and evaluated with test data obtained from a sample of 84 cadaver tests conducted over a 10-year period. The results of those tests represent the largest biomechanical data base that has been used to support a NHTSA rulemaking action. In these instrumented cadaver tests, NHTSA was able to compare the acceleration measured on the cadaver's ribs and spine with the severity of the thoracic injury received by the cadaver during the impact. These tests showed that the occurrence of injuries to the hard thorax, which includes both the ribs and the internal organs protected by the ribs, is strongly related to the average of the peak lateral acceleration experienced by the struck side rib cage and the lower thoracic spine.

TTI can be measured on a test dummy and used as a surrogate for side impact safety performance of passenger cars. Performance requirements for such performance can be specified in terms of a combination of peak rib and spine accelerations measured on the dummy and called the Thoracic Trauma Index (dummy) or TTI(d). This injury criterion represents the average of peak acceleration values measured on the lower spine and the greater of the acceleration values of the upper and lower ribs of the test dummy. The benefits associated with a requirement specifying a particular level of TTI(d) can be predicted by using the TTI to assess changes across the entire population of vehicle occupants.

Included in the 84 cadaver tests mentioned above were a number of tests at the University of Heidelberg that were sponsored by the Forschungsvereinigung Automobiltechnik (FAT), an association of some 30 German motor vehicle and equipment manufacturers. These tests were designed to study lateral impacts to human cadavers, as well as to three different designs of dummies, seated in actual car bodies. Using the cadaver injury data, NHTSA evaluated the performance of the TTI in predicting the severity level of injuries resulting from lateral impacts.

In the FAT tests, which were conducted on a sled, a deformable barrier developed under the auspices of the Committee of Common Market Automobile Constructors (CCMC) was propelled into an Opel Kadett "body in white" in which the test subject (a human cadaver) was seated in the front seat on the struck side. Each car body was struck twice at an angle of 90°, once on the left side, and once on the right side. The speed of the barrier was either 40, 45, 50, or 60 km/hr. Each cadaver was subjected to one crash test. NHTSA's review of the test results, which is contained in the Society of Automotive Engineers paper entitled "Side Impact—The Biofidelity of NHTSA's Proposed ATD and Efficacy of TTI" (SAE Paper No. 861877, Oct. 1986), again showed that TTI effectively distinguished different levels of injury risk. That is, the higher the value of the TTI calculated for the test, the greater was the probability of serious injury to the cadaver.

Despite the extensive support provided by NHTSA for TTI(d) in the NPRM and PRIA, numerous commenters expressed significant concerns about the proposed thoracic injury criterion. Some commenters argued that NHTSA has not demonstrated a good correlation between the TTI and the risk of injury. Peugeot expressed concern about NHTSA's use of data from cadaver tests performed by FAT. That commenter stated that it was evident that a given TTI value could be associated with any "hard thorax" AIS value, ranging from 0 to 5. Peugeot also stated that there was very poor correlation with either abdominal injuries or rib cage injuries. CCMC submitted a comment raising a number of the same concerns as Peugeot.

Honda commented that while NHTSA argued that TTI is able to distinguish injury level according to AIS, an International Organization for Standardization (ISO) document reveals that TTI data overlap different AIS's. Honda cited an ISO resolution concluding that the TTI cannot be considered as an acceptable thoracic protection criterion.

GM stated that when cadaver data published by NHTSA were studied using discriminant analysis techniques, the TTI erroneously predicted injury risk for 20 (43 percent) of 47 possible cases. That company also expressed concern that TTI(d) omits age and weight factors. GM stated that cadaver data published by NHTSA indicate that age accounted for about 40 percent of the magnitude of TTI in the cadaver tests. According to GM, TTI(d) cannot be relied upon to predict injury risk since it ignores a major percentage of the correlation function (TTI) which itself did not correlate for 43 percent of the cases upon which it was based.

Ford argued that although the curves of probability of injury versus TTI presented in NHTSA's PRIA indicate a continuous, sharp decrease in injury for decreasing values of TTI, the actual test data show considerable overlap in regions where the corresponding injuries are of markedly different severity.

That company stated that TTI provides virtually no differentiation between AIS 0 and 1, between AIS 2 and 3, and between AIS 4 and 5. Ford also asserted that NHTSA had found it necessary to "arbitrarily" adjust the probability of injury versus TTI curves on the basis of slight logical inconsistencies. According to Ford, before adjustment, the curves indicate that for all TTI greater than 151, the probability of AIS greater than or equal to 4 exceeds the probability of greater than or equal to 3, a logical absurdity. Ford asserted that these curves demonstrate that the TTI is fundamentally deficient in predicting injury severity.

NHTSA believes that the TTI is a good predictor of risk of thoracic injury. The development and efficacy of TTI as an injury index is documented in detail at pp. IIIB–16 to IIIB–28 of the PRIA. The TTI relates the probability of an individual receiving a thoracic/abdominal injury of severity greater than AIS 3, 4, or 5, depending on the individual's weight and age, as well as the peak rib and spine acceleration responses recorded during the impact event. There is a monotonically increasing relationship between the TTI and the severity of the maximum thoracic/abdominal injury. (Monotonicity refers to a mathematical relationship in which the dependent variable (Y) increases as the independent variable (X) increases, regardless of linearity or non-linearity.)

It should be noted that each TTI level relates to an injury probability distribution. For example, at TTI = 150 g, there is a 75 percent chance of an AIS–3 or greater injury, a 20 percent chance of an AIS–4 or greater injury, and a 0 percent chance of an AIS–5 or greater injury. This is consistent with the variability found in cadaver testing and reflects the range of human injury tolerance in impacts. Thus, NHTSA does not share commenters' concern that a single TTI level can represent several different AIS levels of injury, as that simply reflects the real-world validity of TTI.

GM did not provide sufficient details of its analysis for NHTSA to fully evaluate that company's argument that TTI erroneously predicted injury risk for 20 of 47 possible cases. However, GM's assertion suggests a misunderstanding of what is predicted by TTI. As indicated above, each TTI level predicts an injury probability distribution. It is incorrect to argue that a particular TTI level predicts a particular AIS level injury. This can be illustrated by considering the probability distribution cited above for TTI = 150 g. At that TTI level, there is a 75 percent chance of an AIS–3 or greater injury and a 20 percent chance of an AIS–4 or greater injury. While the probability of an AIS–3 or greater injury is considerably higher than the probability of an AIS–4 or greater injury, it would be incorrect to state that TTI = 150 g predicts an AIS–3 injury. Since GM's analysis appears to incorrectly assume that TTI predicts a single AIS level injury in each case, the agency does not agree with the analysis.

NHTSA also does not agree with GM's argument that the omission of age and weight from the TTI(d) means that it cannot be relied upon to predict injury risk. The likelihood of injury in a crash differs depending upon a person's age and weight, but for any particular age and weight, TTI(d) correlates with actual injury, i.e., risk of injury increases as TTI(d) increases.

The agency disagrees with Peugeot's contention that poor correlation of the TTI with either abdominal injuries or rib cage injuries indicates that there is a problem with the TTI. The TTI was developed to predict injuries to the hard thorax. Efforts to find relationships with individual portions of this body region may well fail because the TTI accounts for the threat to another part of the hard thorax that has been excluded from such an analysis.

NHTSA disagrees with Ford's suggestion that it "arbitrarily" adjusted the probability of injury versus TTI curves based on slight logical inconsistencies. The implication of Ford's comment is that the agency modified the data to prevent the curves from indicating that the probability of AIS greater than or equal to 4 exceeds than the probability of AIS greater than or equal to 3. Ford's statements are incorrect for several reasons. The data were not modified; rather the procedure for calculating the injury probability curve was constrained to avoid this impossible situation. Further, that company's comments were based on the curves generated in a 1984 NHTSA paper which used Probit analysis. TTI as proposed in the NPRM was derived in 1986 and is based on a Weibull analysis. (The terms Probit and Weibull refer to statistical techniques.) As discussed in section IIIB of the FRIA, NHTSA believes that the Weibull distribution is the most appropriate function for describing injury probability from the type of data in question. When Weibull analysis was used in the 1986 analysis (which included many tests of Opel vehicles), none of the inappropriate relationships (injury probability of AIS greater than or equal to 4 exceeding the probability of greater than or equal to 3) were found.

Some commenters argued that the TTI lacks a biomechanical basis and is test-condition-dependent. GM argued that the TTI cannot be relied upon to reliably predict human thoracic injury risk in side impacts because it lacks a biomechanical basis. That company stated that the agency's assertion that the TTI correlates to injury is at best correct only for the narrow conditions under which tests were conducted, since statistical correlations cannot be relied upon when conditions vary from those upon which the correlation is based. According to GM, because

many factors influence injury risk in a side impact (e.g., door stiffness, contour of door interior, vehicle size, velocity, and others), it is vital that the injury risk function be viable for the entire range of vehicles and impacts for which countermeasures are sought.

BMW stated that it is very difficult to find a physical relationship of the TTI with the injury mechanism. That commenter stated that momentary high accelerations of the ribs can lead to fractures, yet transfer little energy to the thoracic vertebrae. According to BMW, since the TTI is the average of the maximums of rib and spine accelerations at different moments in time, the ribs can be broken, while the TTI still remains within the limit specified in the rule because the value for spine acceleration is low.

Mercedes-Benz stated that the theory of the TTI is based on the assumption that the injury mechanism of the thorax and lower ribcage protected abdominal organs (liver, spleen, kidney) is equally determined by the behavior of the thoracic skeleton. That commenter stated that this theory is not confirmed by injuries from side-impact collisions or by the results of FAT tests. Mercedes stated that anatomically logical separation of thorax and abdomen is valid for injury protection and must be reached through appropriate separate protection criteria.

Peugeot commented that it is difficult to conceive how adding the peak rib acceleration as measured very early in the impact phase to the peak acceleration of the spine as measured in the late stages of the impact can be related to the mechanism of rib and organ injury. Peugeot also argued that although advocates of TTI may consider it to be a good predictor of thoracic injury because a quasi-statistical correlation was found between the TTI values calculated from cadaver tests and the resulting thoracic injury levels, regression analysis produces substantially different relationships for each test condition, suggesting that the TTI is test-condition-dependent. That commenter also argued that accident analysis does not support the TTI. According to Peugeot, the TTI mistakenly presupposes a strong relationship between abdominal and thoracic injuries. Peugeot stated that such a link exists, but only for 17 percent of cases.

NHTSA acknowledges that the TTI represents an empirical formulation as opposed to an injury criterion primarily derived from biomechanical theory. The agency believes that use of an empirical formulation in this instance is acceptable and appropriate for a number of reasons.

The TTI formula was derived from a data base of 84 tests performed on human cadavers in over 20 different test conditions (including speed conditions and impact environments). These tests included pendulum tests, rigid and padded wall sled tests, and full scale vehicle tests ranging in speed from 10 to 40 mph. Padded wall conditions included a variety of materials of various thicknesses. The cadavers ranged in age from 17 years old to 84 years old. NHTSA believes that the test conditions underlying the TTI span and encompass the spectrum of anticipated impact conditions in the full-scale side impact crash test procedure proposed by NHTSA, which itself is representative of real world crashes.

The agency notes that, while the general relationship between TTI and the probability of different AIS level injuries can be seen when all of the cadaver tests are used, the final TTI formulation was derived using the 36 tests in which the cadaver was struck on the left and where both rib accelerations were available. For a more complete discussion of the data underlying TTI, see the Society of Automotive Engineers paper cited above, "Side Impact—The Biofidelity of NHTSA's Proposed ATD and Efficacy of TTI." (SAE Paper No. 861877, Oct., 1986).

Given the data base underlying TTI, the agency is confident that the relationship between TTI(d) and injury risk is valid for the entire range of vehicles and impacts for which countermeasures must be designed in order to meet the dynamic side impact test requirements. This makes TTI(d) appropriate as an injury criterion in a side impact crash test, even though it is based on statistical correlation.

NHTSA notes that the TTI(d) is only valid for lateral impact conditions, the condition specified in the side impact test procedure. NHTSA does not intend that the TTI(d) be used in any test condition other than lateral impacts.

NHTSA also notes that, in addition to being predictive of actual injury, the TTI is consistent with observations pertaining to impacted bodies. For example, TTI is consistent with the fact that the elderly and larger/heavier persons are more prone to injury for a given level of rib and spine acceleration, and with the fact that persons are more prone to injury when exposed to higher accelerations.

Since the TTI is an empirical formulation, the agency does not agree with the assertion of Mercedes-Benz that the theory of the TTI is based on the assumption that the injury mechanism of the thorax and lower ribcage-protected abdominal organs is equally determined by the behavior of the thoracic skeleton. With respect to that commenter's argument that separate protection criteria are needed for the thorax and the abdomen, NHTSA notes that the proposed requirements were not intended to address all abdominal injuries. As discussed below, the agency believes that lateral abdominal compression measurement has not yet been

perfected as an injury criterion. However, many abdominal injuries are addressed by protection of the hard thorax, and are predicted by TTI(d).

NHTSA disagrees with Peugeot's claim that regression analysis suggests that TTI is test-condition-dependent. According to Peugeot, such analysis shows different relationships for each test condition. That company's analysis consisted of producing subsets of the NHTSA side impact data based on test conditions (e.g., one subset for padded sled tests, another for vehicle tests, yet another for pendulum tests, etc.) and then looking for the relationship between the reported injury level and the reported TTI value. NHTSA analyzed the cadaver test data, which it broke into sub-sets. NHTSA believes that it used the same data as Peugeot, although Peugeot did not submit their analysis with their comments. NHTSA performed regression analysis of the data for different test conditions. The regression analysis shows similar trends in the overall correlation of TTI and injuries for each test condition. The agency, therefore, does not accept Peugeot's conclusions.

NHTSA also disagrees with Peugeot's arguments that a standard based on TTI(d) cannot offer abdominal protection. NHTSA notes that the lower rib accelerometer and the lower spine accelerometer (used on the dummy to measure TTI(d)) are located close to where abdominal organs such as the liver, spleen, and kidneys are found on a human. In addition, NHTSA has found a relationship between the probability of AIS injuries and TTI. This is significant because AIS injuries 4+ and 5+ include injuries to three abdominal organs (i.e., the liver, spleen, and kidneys). Further, the agency believes that company's own data contradict its claims. Assuming that pelvis protection is offered as well as thoracic protection, Peugeot's data show that 78 percent of the abdominal injuries were accompanied by rib fractures (that company did not analyze other thoracic injuries), pelvis fractures, or fractures to both pelvis and ribs.

While rib deflection is not directly reflected in the TTI, the agency notes that the TTI correlates with the number of rib fractures. As discussed in the FRIA, NHTSA examined this relationship, using rigid and padded wall cadaver data, and found a strong correlation. The agency therefore concludes that the use of TTI(d) as a performance criterion can significantly limit and control the number of fractured ribs caused by lateral impacts in vehicle collisions. NHTSA therefore does not share BMW's concern that ribs can be broken while TTI remains under the required limit because the value for spine acceleration is low.

A number of commenters argued that the TTI is fundamentally flawed because it is acceleration-based. According to GM, the TTI relates poorly to injury risk because peak accelerations do not relate well to important mechanisms of human chest and abdominal injury. That company acknowledged that acceleration does have some relationship to the overall severity of a crash, but argued that simply combining peak accelerations at two skeletal points, at two instants of time, is insufficient to discriminate between thoracic injuries for a variety of exposures.

Ford asserted that there is "worldwide biomechanical disagreement" with NHTSA concerning TTI, based on the inability of TTI(d) or any other acceleration-based injury criterion to represent quantitatively the likelihood of injury to organs in the human chest.

MVMA noted that accelerations used to calculate TTI are measured by accelerometers attached to the ribs and spine. That commenter stated that since the human chest is not totally rigid but instead consists of various flexible components, measuring acceleration of the rigid dummy spine or ribs will not reliably predict injury to the viscous organs within the chest. MVMA also stated that if "whole body loading" does not occur (i.e., if a concentrated load is applied), acceleration of the spine or ribs may be small and thus fail to predict injuries which occur due to chest compression.

Peugeot commented that transversal acceleration measured at the rib is at best only an indication of violence but in no case an acceptable indicator of thoracic lesion. That commenter also stated that thoracic acceleration alone does not enable one to account for both deformation of the car side-wall and deformation of the thorax. Peugeot commented that the same thoracic acceleration value can be obtained with a not-very-rigid side-wall and a too-rigid dummy thorax, or with a too-rigid side wall and a very deformed dummy thorax, and therefore predict the same level of thoracic injury.

The requirements proposed by NHTSA were designed to reduce hard thorax (includes skeleton as well as organs like the liver, kidney, heart and spleen) and pelvic injuries associated with accelerations. Acceleration is one of a number of possible measures of the severity of the injury that occurs to a person in a crash. NHTSA believes that the critical question is whether the TTI(d) injury criterion, consisting of acceleration measurements, can discriminate the risk of hard thorax injury in simulations of real-world side impact crashes. The agency believes that available evidence indicates that TTI(d) can do so. In other words, as TTI(d) is reduced, the risk of injury is also reduced. A reduction in TTI(d) signifies that the severity of injury to a person in a crash, as measured by acceleration, is reduced. Severity of injury as measured by other means, such as compression, may also be reduced, although it is not measured as part of TTI(d). As long as the TTI(d)

injury criterion can discriminate risk of thoracic injury, the agency believes that the precise injury mechanism (acceleration, compression, some combination of forces, etc.) is not critical.

NHTSA disagrees with MVMA's contention that accelerometers attached to the ribs and spine cannot reliably be related to injury to the viscous organs within the chest. Since accelerometers on the ribs and spine are located close to the viscous organs within the chest, they measure parameters that may cause viscous organ injuries. Countermeasures that result in reduced accelerations on the ribs and spine will also generally result in reduced severity of injury to the nearby viscous organs, reducing the risk of injury.

With respect to MVMA's argument that TTI(d) might not discriminate a concentrated load, NHTSA notes that full body loading is typical of side impact crashes. Acceleration measurements taken from the rib and spine indicate the severity of injury involved in impacts such as those caused by armrests.

NHTSA does not agree with Peugeot's concern that the same thoracic acceleration value can be obtained with a not-very-rigid side-wall and a too-rigid dummy thorax, or with a too-rigid side wall and a very deformed thorax. By specifying an appropriate test dummy (an issue which is addressed in the separate notice on SID), and hence establishing the stiffness of the dummy, the agency can ensure that the TTI(d) measured in a crash test is comparable to what would be experienced by persons in real world crashes. NHTSA notes that Peugeot's comment is related to the argument raised by a number of commenters that the SID chest is overly stiff. A full discussion of that issue is presented in the separate notice on SID.

Several commenters argued that the TTI may not suggest appropriate countermeasures since it does not describe the time when injury to the thorax occurs. MVMA noted that the peak spine and peak rib accelerations do not necessarily occur at the same time. Consequently, according to that commenter, TTI(d) does not necessarily represent the actual risk of injury.

NHTSA notes that, while TTI correlates well with the occurrence and severity of injuries, this does not mean that the occurrence of either peak acceleration response corresponds exactly in time to the occurrence of body injury. Parameters measured on the skeleton, such as acceleration, do not necessarily give the precise time of peak local stress or strain to the hard thorax or whatever mechanism causes a local injury. While the exact time of injury occurrence may be desirable from a researcher's perspective, it is unnecessary for purposes of regulation. In establishing a performance requirement that meets the need for safety, NHTSA is concerned whether an injury criterion predicts the probability of differing levels of overall thoracic injury that a person would experience in a real-world crash, and not whether it can be used to determine the mechanism or exact timing of such injury.

Several commenters argued that the use of the TTI could lead to designs which provide little or no safety benefits. GM cited the results of armrest tests in support of this argument. SID dummies and anesthetized swine were impacted using a six-inch-diameter pendulum fitted with simulated armrests of different stiffness. According to GM, the SID/TTI results indicated that the stiffest armrest posed the least risk, while the swine/TTI results indicated that the softest armrest was preferable. That company stated that autopsies of the swine showed similar soft tissue liver lacerative injuries for each case, indicating that all of the armrests posed similar risks.

NHTSA notes that GM's armrest tests involved applying a concentrated load to the SID dummies and swine. However, as indicated above, side impact crashes typically involve full body loading, and TTI(d) predicts thoracic injury risk in such impacts.

The agency does not wish to imply that armrest design is unimportant for side impacts. Accident data indicate that armrests cause injury to both the pelvis and the abdomen. While the EuroSID and BioSID (other side impact dummies being developed by the European Economic Community and the Society of Automotive Engineers, respectively) were designed with abdominal load sensors, the SID dummy was not. The EuroSID and BioSID dummies are discussed further in the separate notice covering SID. NHTSA has conducted experiments with frontal abdominal injury sensors and developed injury criteria for the Hybrid III dummy and believes that direct lateral abdominal measurement has not yet been perfected as a compliance tool. Some armrest injuries are addressed through the measurements of TTI(d) with the SID. The TTI(d) criterion is based on injuries to the hard thorax, which includes some but not all abdominal organ injuries. Also, the limit on pelvic acceleration addresses armrest injuries to the pelvis. Moreover, even though some armrest injuries are not addressed, armrests are not likely to become more aggressive as a result of the TTI(d) or pelvic g requirements. The agency also notes that, as discussed further below, the fact that the proposed test procedure does not completely address armrest injuries is a reason to retain the existing armrest requirements of Standard No. 201, Occupant Protection in Interior Impact.

BMW stated that since the TTI is comprised of maximum acceleration values only, it necessarily reacts very sensitively to damping. That commenter stated that it is possible that, in some cases, through

the use of padding, the TTI value will be reduced without a corresponding increase in real-world safety. BMW cited a study showing that with a damping material which reduced the energy input by less than nine percent, the injury risk as measured by TTI was reduced from 83 percent to 20 percent. That commenter expressed doubt that the actual injury risk for human occupants is reduced to this extent. Chrysler raised similar concerns.

As indicated above, TTI correlates well with the occurrence and severity of injuries. NHTSA believes that the addition of interior padding can often result in a significant reduction of injury risk. Depending on TTI(d) level and AIS level of injury, the agency considers it likely that a small reduction in energy input may make the difference in whether a person receives a serious injury or not.

GM and Ford each argued that the use of TTI(d), coupled with what they consider to be the excessive stiffness and excessive mass of the SID chest, could lead to the use of interior padding that is overly stiff and could actually degrade occupant safety, particularly that of the elderly. Honda stated that since the bone condition factor (bone flexibility) is not taken into consideration for TTI, the severity of injury in the real world may possibly be increased by countermeasures aimed at decreasing TTI.

NHTSA disagrees that the use of TTI(d) and the SID would lead to the use of interior padding that is so stiff that it would increase injuries to the elderly or any other group of persons. Any padding that is added to a car to reduce TTI(d) would be less stiff than the interior car door and make a contribution to improving occupant safety for persons of all ages. As indicated above, for persons of any particular age, TTI(d) correlates well with the occurrence and severity of injuries. Ford appears to be concerned that very stiff padding might be necessary to meet the proposed requirements, whereas softer padding might provide even greater benefits to the elderly. NHTSA notes that one potential answer for this concern is for the manufacturers to utilize a combination of structure and padding to meet the test requirements.

NHTSA notes that, as part of research comparing SID with two side impact dummies still in the research stage, EuroSID and BioSID, the agency recently conducted a series of tests to examine the effect of padding stiffness upon the injury hazard measurements of these dummies when subjected to a given test condition. Each of these dummies was exposed to a series of 20 mph lateral impacts into a rigid wall which was padded with three inch thick foam padding of varying stiffnesses. The padding stiffness varied from very soft to nearly as stiff as the rigid wall. Using TTI(d), all three dummies indicated that the very soft and very stiff padding are the most hazardous in impact situations. There was very little difference between the three dummies in the choice of an optimal padding. The optimal padding stiffness determined by the three dummies ranged approximately from 15 to 25 pounds per square inch, measured at 35 percent compression. For BioSID, a slightly stiffer padding was selected for V*C than for TTI(d). (V*C is a compression-based injury criterion advocated by GM and other commenters as an alternative to TTI(d) where V is velocity of chest compression and C is lateral chest displacement.) While, as discussed below, the data supporting V*C are limited, NHTSA observes that to the extent that it is a valid injury criterion, these BioSID results contradict the argument that use of TTI(d) would cause manufacturers to select overly stiff padding. A further response to this issue, particularly with respect to concerns about effects relating to the stiffness and mass of the SID chest, is provided in the separate notice on SID.

Nissan expressed concern that, in tests it conducted using SID dummies, the correlation trend for door padding material hardness and TTI(d) was different from the correlation trend for V*C and chest compression. That company stated that the padding hardness required to minimize TTI(d) values on the one hand, and to minimize V*C and rib deflection values on the other, did not match. Nissan stated that it thinks padding is effective for minimizing dummy readings in side impacts, but that the appropriate padding hardness has not yet been identified.

NHTSA notes that SID was not designed to measure V*C or rib deflection. In order for a test dummy to produce human-like readings of V*C or rib deflection, the dummy must have biofidelity for chest compression. However, SID was not designed to have biofidelity for chest compression. It was designed for biofidelity in measuring TTI(d), which the agency found to be a measure strongly related to thoracic injury. Therefore, the agency believes that SID cannot be validly used to develop a correlation trend for V*C or rib deflection.

Nissan also stated that it had compared the TTI to driver fatality rates in side impacts using 1986 FARS data and did not find a close correlation. Ford commented that while NHTSA had tested production cars with its proposed test procedure, it had not shown that the test results are correlated with human injuries in traffic accidents in those same cars.

NHTSA notes that it tried to correlate the TTI(d) from 12 models it tested with fatality and injury rates in side impacts, and found a poor correlation. However, NHTSA does not believe that this calls into question the reliability of TTI(d). Staged testing often does not correlate well with real world crashes.

With a limited number of models to compare, the number of cases found are small and of differing speeds and circumstances. The chances of finding a reliable correlation are thus very small.

The agency has, however, compared accident data for 2-door and 4-door cars, which have different average TTI(d) levels, to determine whether the differences are reflected in the accident data. As discussed in section IIIC of the FRIA, the average driver TTI(d) measurements in a 2-door car are about 14 percent higher than in a 4-door car, while the rear passenger readings are about 14 percent lower. The results of the 2-door/4-door accident data comparisons are directionally consistent with what would be expected from 2-door/4-door TTI(d) comparisons, and relatively close to TTI(d) differences found in matched pair 2-door/4-door side impact testing. After adjusting for age, 2-door cars have higher injury rates in the front seat and lower injury rates in the rear seat than 4-door cars. In this respect, test results are representative of real world accident data.

Ford stated that it urged in 1980 (in a comment on a side impact ANPRM) that NHTSA conduct accident reconstruction-restaging studies to relate field injuries to dummy responses in simulated accidents. That company recommended at the same time that NHTSA should conduct full vehicle dynamic side impact tests with cadavers on board the target vehicle instead of dummies. Ford noted that the cadaver results could then be compared to accelerations previously measured on the SID to confirm dummy-cadaver injury relationships under actual compliance conditions. Ford stated that it still believes NHTSA should perform such studies and tests before issuing a final side impact rule.

While NHTSA does not disagree that the testing suggested by Ford would be relevant, there are limits to how much testing can be conducted to support a particular rulemaking. It would be difficult and expensive to conduct additional full scale vehicle tests with cadavers on board. NHTSA notes that the FAT tests, discussed above, did involve testing actual car bodies with cadavers. NHTSA believes that the results of those tests, along with other tests, make additional cadaver testing unnecessary. The agency notes that regardless of how many tests and studies it conducts, it would always be possible to do more. NHTSA believes that the tests and studies it has conducted in support of this rulemaking are fully adequate.

2. Estimated Benefits of the TTI(d) Performance Criterion

NHTSA explained in the NPRM that, as part of its side impact protection research program, it had conducted 20 crash tests of 12 production passenger cars using the proposed test conditions and SID. To evaluate the effects of meeting a specified thorax performance criterion, the agency analyzed the probability of thoracic injury for each of the cars in the 20 tests, using the TTI and other factors, and compared this to the level of injury that would occur for each of the alternative values of the proposed TTI(d) thorax criterion. The estimated benefits for the different levels of the proposed TTI(d) thoracic injury criterion were calculated, based on the assumption that the production vehicles tested by NHTSA were representative of the total fleet of new cars. That is, all cases exceeding a particular chosen maximum TTI(d) were reduced to the specified level, while all vehicles having lower values retained their original values. Injury distributions were then recalculated using the altered TTI(d) values.

Subsequent to issuance of the NPRM, the agency conducted eight additional production vehicle tests, using eight different models. One model was also tested by Transport Canada. In addition, the agency received, as part of comments, test data on 25 additional models from four different motor vehicle manufacturers. NHTSA notes that the data from the manufacturers were submitted under claims of confidentiality.

In estimating benefits, NHTSA's FRIA uses only data from those more recently designed models (model year 1984 and later). These data include 23 models, 10 2-door models and 13 4-door models. The FRIA assumes, among other things, that the 23 models are representative of the current fleet of vehicles on the road and of the fleet of vehicles that will be produced in the near future. Results, which take into account the increased safety belt usage seen in recent years and expected for the future, are shown in Table 1. As with any requirements for new vehicles, the benefits accrue over the 10–15 year life of the model year fleets affected. For additional explanation of the data underlying Table 1, see Chapter IV of the FRIA.

The methodology used in the FRIA for estimating benefits is essentially the same as that utilized in the PRIA, with some minor adjustments. The estimated benefits are somewhat lower because they rely on new data from more recently designed models. These data indicate that the average TTI(d) of vehicles in the new car fleet is lower than previous data supporting the calculations in the PRIA suggested. NHTSA believes that the new data reflect the improvements by a number of manufacturers to the side impact protection of their vehicles over the past several years, while this rulemaking has been progressing.

3. Alternative Thoracic Injury Criteria

General Motors has developed what is known as the viscous injury criterion (V*C) for use in analyzing soft tissue injuries in frontal impacts. This

TABLE 1
THORAX BENEFITS FOR DIFFERENT
MAXIMUM LEVELS OF TTI(d)
PERFORMANCE IN THE BASELINE FLEET

	TWO-DOORS		FOUR-DOORS		TOTAL FLEET	
TTI(d)	AIS 3–5	FATALS	AIS 3–5	FATALS	AIS 3–5	FATALS
80	1,922	504	681	218	2,603	722
85	1,714	450	399	117	2,113	567
90	1,450	381	178	49	1,628	430
95	1,130	290	63	22	1,193	312
100	765	203	0	0	765	203
105	422	123	0	0	422	123
110	100	37	0	0	100	37
115	43	20	0	0	43	20

injury criterion is based on the product of the instantaneous thorax compression (C) and the rate of thorax compression (V) that occurs during the impact.

In the NPRM, the agency stated that while it believed that the work GM has done with the V*C shows that such an approach may be promising, there were insufficient data to support adopting V*C as a criterion for assessing vehicle safety in side impacts. The agency also stated that there were no dummies designed with biofidelity for measurement of lateral V*C. NHTSA noted that, in contrast to the V*C criterion, the agency has a substantial amount of cadaver impact tests that indicate that TTI(d) is a reliable predictor for thoracic injuries, as well as a fully developed and validated test dummy.

Many commenters argued that a compression-based injury criterion, such as V*C or rib deflection, would be superior to TTI(d) or other acceleration-based injury criteria. GM noted that acceleration has long been used as a criterion of some merit because it provides some indication of the forces which are imposed on the body. According to that company, however, more recent studies have shown that thoracic compression is an essential discriminator of injury potential, particularly as regards the soft organs of the chest. GM stated that, in general, the more the chest is compressed, the greater the potential for injury, particularly at low rates of compression.

Since the NPRM was published, GM has continued its work with respect to V*C, including the development of a new dummy, called BioSID, designed to measure chest compression and derive V*C. Also, GM conducted a series of 14 cadaver tests, the results of which, according to that company, indicate that V*C relates closely to the injury patterns observed with the cadavers.

Ford commented that it and others believe that injury criteria based on the compression of the chest during a crash impact have a greater potential to predict the likelihood of chest injury in a side impact crash than does TTI(d). According to that commenter, the ability of compression-based injury criteria to predict injury has been well substantiated by experiments with human cadavers and live animals, and is supported by biomechanical theory. Ford stated that it believes that some combination of chest compression and velocity of chest compression will likely emerge as the most suitable criterion. That company argued that NHTSA should not promulgate a final rule until an injury criterion and test device based on chest compression is developed and evaluated.

After considering the comments, NHTSA is not persuaded that V*C or a similar approach should be used in this rulemaking. As discussed above, the agency believes that TTI(d) is a reliable predictor for thoracic injury and the agency has a fully developed and validated dummy for measuring the TTI(d). The data supporting V*C are much more limited than those supporting TTI(d). Also, while GM has made considerable progress with BioSID, SID has been the subject of an NPRM and seen much wider use. NHTSA does not believe that V*C is necessarily any better an injury predictor than TTI(d) and notes that further work in validating V*C would significantly delay the rulemaking. Since TTI(d) and SID are ready now, and a final rule specifying TTI(d) can result in significant safety benefits, the agency believes it is appropriate now to go to a final rule using TTI(d). If V*C or another injury criterion should later be shown to offer additional benefits, and to be measurable by appropriate test dummies, the agency can then consider specifying such a criterion in addition to, or in place of, TTI(d) at that time.

B. Pelvis

As discussed in the NPRM, NHTSA has done research to develop criteria to limit pelvic injury in side impacts. The research, which has been pub-

lished in a paper, "Synthesis of Pelvic Fracture Criteria for Lateral Impact Loading," presented at the Tenth International Technical Conference on Experimental Safety Vehicles, reviewed data from the above-mentioned 84 cadaver impact tests which measured the acceleration of the pelvis. As a result of that review, the agency developed estimates of the probability of pelvic fracture for different acceleration levels measured in the pelvis of the cadavers.

NHTSA is concerned that certain vehicle design modifications could reduce thoracic response in side impact crashes by shifting the load path into the pelvis. A pelvic injury criterion was proposed to prevent the concomitant worsening of pelvic protection.

The NPRM explained that, in order to evaluate the effects of requiring cars to meet various maximum pelvis acceleration levels, the agency estimated the probability of pelvic injury for each of the 12 production passenger cars that were crash tested in the agency's research programs. The agency then calculated the expected benefits derived from having vehicles comply with various limits on pelvic acceleration levels.

NHTSA's FRIA uses the same approach for calculating benefits for the pelvis. However, the FRIA uses the above-referenced data from the 23 more recently designed vehicle models. Results, which take into account the increased safety belt usage seen in recent years and expected for the future, are shown in Table 2.

Table 2.—Estimated Pelvic Fracture Injury Reduction

Alternative levels of peak pelvic G's	Nonfatal fractures
130	774
150	316
170	40
190	0

C. Prohibiting Door Openings

The potential benefits of requiring the doors to remain closed during a side impact consist of reducing the number of persons who are ejected from a car through a door and strike an object outside the car. NHTSA stated in the NPRM that its review of the results of the 12 vehicle crash tests showed that a door on four of the vehicles opened during the crash. The agency then estimated the number of ejections that occur in side impacts and evaluated the potential effectiveness of keeping the door closed in reducing occupant deaths and injuries. NHTSA tested eight additional models after issuing the NPRM. None of the additional vehicles had a door open during the crash test.

The FRIA estimates that the requirement prohibiting door openings will eliminate 14 fatalities and 13 serious-to-critical injuries each year. These estimates take into account the increased safety belt usage seen in recent years and expected for the future. The estimated benefits are lower than estimated in the PRIA, based upon the use of data from additional crash tests. In addition, as discussed below, the agency decided not to include near-side ejections in its benefits analysis.

NHTSA anticipates that the improvements that might be made to keep doors from opening during the side impact test would also be of benefit in frontal, rear, or rollover crashes, but these potential benefits are not included in the FRIA's estimates.

Ford requested clarification of some of the proposed requirements prohibiting door opening. The proposed language for section S5.3.2.2 (S4.3.2.2 in the NPRM) stated that neither the latch nor the hinge systems of the door shall separate. Ford stated that the meaning of the word "separate" is unclear. That commenter asked what parts are not to separate from one another. NHTSA notes that the meaning of the word "separate" is disengagement or release from attachment and/or connection. This provision requires that the latch must not separate from the striker, and the hinge components must not separate from each other or from their attachment to the vehicle. NHTSA has modified the wording of this provision to make this clear.

The proposed language for section S5.3.2.3 (S4.3.2.3 in the NPRM) stated that neither the latch nor the hinge systems of the door shall pull out of the anchorage. Ford stated that the meaning of "the anchorage" is unclear. That company stated that inasmuch as at least two components are mentioned, i.e., the latch and the hinge systems, it is not clear to which component "the anchorage" pertains. NHTSA has modified the wording of this provision to state that neither the latch nor the hinge systems of the door shall pull out of their anchorages. The agency notes that the word "anchorage" refers to the provision for transferring latch and/or hinge loads to the vehicle structure. The term "anchorage" includes, but is not necessarily limited to, the attachment hardware used to attach these components to the vehicle structure.

D. Comments on Benefits Analysis

NHTSA received numerous comments arguing that the benefits estimated by the agency were overstated. The more significant comments are discussed below, with the exception of concerns about the SID, the TTI versus risk of injury curve, and the MDB. While those concerns are relevant to benefits, they are addressed elsewhere in this preamble or in the separate notices addressing the SID and the MDB. A more complete discussion of comments

concerning benefits is provided in Appendix IV–A of the FRIA.

Many commenters argued that the agency included inappropriate crashes or injuries in its benefits analysis. CCMC argued that although the NPRM was supposed to address car-to-car impacts, the injury data base used by the agency included all types of obstacles with which a car would collide. That commenter stated that the analysis should have excluded truck-to-car, or car-to-pole/tree accidents which generally produce severe-to-fatal head injuries. GM also argued that the agency should not include benefits for single vehicle impacts, since this is not the focus of the rulemaking.

NHTSA included in its benefits analysis only those cases in which the most serious injury occurred in the chest, abdomen, or pelvis. Head injuries were not included. The agency does not believe that there is any reason to limit the benefits to car-to-car impacts. The addition of padding or structure should be of benefit to occupants no matter what type of vehicle or fixed object is impacted. NHTSA notes that it has conducted one set of pole tests that indicated similar benefits from countermeasures as in the barrier tests.

CCMC expressed concern, with respect to direct impact to the pelvis, that all near-side occupants are considered without taking into account the pattern and risk of injury or whether the occupant is directly hit or not by the striking car. NHTSA does not believe there is any need to limit the benefits to those cases where the occupant compartment is struck or to exclude those cases where intrusion injured the occupant. The agency believes that the countermeasures, especially padding, will be just as effective even if the rear side of the car is struck, although these impacts rarely involve the more serious injuries. In terms of intrusion, no benefits are assumed above 35 mph delta V, which eliminates some of the more serious intrusion cases. (The term delta V refers to the change in velocity experienced during an impact. The delta V experienced by the target car during the proposed full scale dynamic side impact crash test ranges from about 12.5 mph for a large car to 17 mph for a small car.) The new requirements will limit injury, but not necessarily intrusion, in a fairly severe impact. CCMC suggested a cutoff at a closing speed of 18 mph. The agency believes that 18 mph is too low of a cutoff. NHTSA has performed tests demonstrating the effectiveness of structure and padding countermeasures as high as 21.2 mph delta V.

Ford stated that the agency should not have included rollover and ejection crashes in the analysis of thorax/pelvic injury benefits. That commenter stated that NASS data indicate that 20 percent of car occupants with moderate or worse injury in side impacts were ejected from the car, and that an additional seven percent of these occupants were involved in a rollover but not ejected. Ford argued that these 27 percent should not have been included in the agency's benefits analysis.

NHTSA's benefits analysis examines the most severe injury to the occupant by injury source and includes only those chest, abdominal, upper arm and shoulder injuries that resulted from contact with the interior door or door hardware/armrest. All occupants that suffered their most severe injury outside of the car are excluded from the benefits analysis because the countermeasures that will be implemented in response to this rule will only benefit occupants who remain in the struck car. Occupants who were involved in a rollover but not ejected are included if they had injuries to the chest, abdomen, upper arm or shoulder that resulted from contact with the interior door or door hardware/armrest. To the extent that padding is the countermeasure utilized, NHTSA believes that these occupants would benefit from the padding. While it is not as clear whether such occupants would get the same level of benefits from structural changes, this group of occupants is a very small part of the target population.

Ford also argued that near-side ejections should not be included in the analysis of door retention benefits. That company stated that the proposed dynamic side impact test confirms door retention on the far side only, since the near side door is pinned in by the barrier and cannot open. The agency's original analysis, however, considered benefits for all door ejections. After considering Ford's comment, NHTSA decided to take a conservative position on this issue and exclude the near side ejections from its benefits calculations for reducing side door openings. Since the side impact test procedure does not represent an oblique collision, where the corner of a striking vehicle could impact one edge of the door, causing the other end to open, manufacturers will not be required to design for such a collision. That change is reflected in the FRIA's benefits estimates cited above. However, although the near side door is trapped shut in the test, the agency believes that a small amount of benefits due to reduced ejections are likely to result from the upgrading of hinges and latches, in near side crashes where the occupant's door is not trapped shut.

NHTSA also received a number of comments criticizing its benefits analysis for reasons other than the merits of including particular types of crashes or injuries. GM argued that NHTSA had incorrectly assumed a constant countermeasure effectiveness at all crash severities. That commenter stated that padding does not have the same effectiveness at all speeds. According to GM, padding that is designed for a range of impacts will be less effective at speeds

below the range because all of its energy absorption potential will not be used. At higher speeds it will be less effective because the padding can "bottom-out" before the impact is complete. GM also argued that the severity of the proposed crash test is too severe to address the greatest number of injury exposures. According to that company, the proposed crash test discourages countermeasures which could be more effective at lower impact speeds, where a greater number of injuries occur.

NHTSA notes that, as discussed in the FRIA, available data indicate the same countermeasure effectiveness at delta V's from 13.3 mph to 21.2 mph. Most injuries occur below 21 mph delta V. The agency assumed no effectiveness above 35 mph delta V. While effectiveness may vary somewhat for different speeds, the agency does not have any data to make specific adjustments. Thus, NHTSA implicitly assumes that the differences in effectiveness, some higher and some lower, would balance out over the range of injuries. NHTSA did not select a lower speed because it wants to reduce the incidence of the most severe injuries and fatalities, rather than merely reducing the incidence of minor injuries such as bruised ribs.

GM also argued that because many fatalities involve very high speed impacts and significant deformations of side structures, about 70 percent of the nearside occupant fatalities that result from chest and abdominal injuries are unpreventable by practical design changes. NHTSA believes that this estimate is overly high. In the agency's 1984 analysis of the potential benefits of automatic restraints, about 40 percent of all fatalities were believed to be unsurvivable with any restraint system. These unsurvivable cases had either catastrophic intrusion into the passenger compartment or delta V greater than 45 mph. While the percentage could be higher in side impact crashes, the agency does not believe that it would approach 70 percent. The FRIA, in Appendix IV–A, evaluates available NASS data as a test of GM's 70 percent estimate. The agency examined cases cited by GM and other cases with similar delta V's and compartment intrusion. In those cases, NHTSA found that there were more survivors than fatalities. Thus, NHTSA disagrees with GM's assertion that 70 percent of the cases in this category are unsurvivable.

GM also cited a hypothetical benefits comparison in support of its contention that the agency overestimated benefits. That company argued that if side improvements are 20 percent as effective as air bags are in frontal impacts (assumed to be 30 percent effective), then only 96 fatal chest and abdominal injuries in multi-vehicle side impacts could be prevented. NHTSA does not agree with GM's assumption that air bags are only 30 percent effective in frontal impacts. The agency has previously estimated that air bags are 20 to 40 percent effective *overall*. Since overall air bag effectiveness derives principally from frontal impacts, which represent about 50 percent of fatalities, NHTSA estimates air bag effectiveness to be 40 to 80 percent in frontal impacts. Also, GM did not offer any basis for its assumption that side improvements will be only 20 percent as effective as air bags. Thus, NHTSA does not agree with GM's analysis.

CCMC commented that NHTSA's estimation of benefits does not take into account the age of occupants. However, contrary to that commenter's belief, occupant age is included in the analysis by including the probability of occupant thoracic injury by age and by weighting occupants in side impacts by age.

VI. Test Procedure

A. Speed, Angle and Point of Impact

In developing the NPRM, the agency examined the data in the National Crash Severity Study (NCSS) to establish the appropriate impact velocities and impact point to be used in the Standard No. 214 crash test. By using the NCSS data, NHTSA determined the median speed of side impact accidents (26 mph striking vehicle/13 mph struck vehicle), and the median speed of accidents that caused serious injuries or death (35 mph/17.5 mph). Based on its analysis of accident data and its judgment about the threshold speed of serious injury accidents, NHTSA tentatively decided that the threshold speed of serious injury (30 mph/15 mph) was the most appropriate test speed.

The agency also reviewed the angle of orientation between the longitudinal axis of the striking and struck vehicles and determined that 90 degree impacts were the most frequent. In view of the potential difficulty of conducting tests in which both the target and striking vehicles are moving and in which the first contact must be made at a specified location on the target vehicle, NHTSA devised a test in which only the striking "vehicle" is moving. Using vector analysis, the agency combined the impact speed and impact angle and determined that the dynamics and forces of a crash in which a vehicle traveling at 30 mph perpendicularly striking the side of a vehicle traveling at 15 mph could be represented by a test configuration in which:

- the test vehicle is stationary;
- the longitudinal centerline of the moving deformable barrier (MDB) is perpendicular to the longitudinal centerline of the test vehicle;
- the front and rear wheels of the MDB are "crabbed" at an angle of 27 degrees to the right of its

longitudinal centerline in a left side impact and to the left of that centerline in a right side impact; and

- the MDB moves at that angle and at a speed of 33.5 mph into the side of the struck vehicle.

NHTSA examined crashes involving serious to fatal injuries to determine the median value of the impact points. The impact reference point describes the relative positions of the striking vehicle and the struck vehicle at the time of impact. In particular, the agency defined the impact reference point, for the purpose of a left side impact, as the position of the left forward edge (corner) of the striking vehicle when contact is first made with the left side of the struck vehicle. This definition is based on crash data which included documentation of the damage that occurred to the side of the struck vehicle. A value of 37 inches forward of the center line of the wheelbase of the struck vehicle was determined. This means that for a left side impact, the left edge of the striking vehicle would be 37 inches forward of the mid-point of the wheelbase of the struck vehicle at the time of initial contact.

GM argued that the proposed impact speed is too severe. According to that commenter, designing a door for a test at 30 mph may provide only limited improvement at some other speeds, and will provide diminished protection at the lower speeds at which most preventable injuries occur. That company argued that the importance of impact speed is enhanced by its findings that older people are overrepresented in side impact injury statistics. GM noted that impact tolerance for older occupants is lower at all speeds than it is for younger occupants, and stated that it follows that the use of softer energy absorption materials should be considered.

NHTSA disagrees with GM's argument that the proposed test impact speed is too severe. As indicated above, the basis for the proposed test impact speed is NCSS crash data, and the proposed test condition represents one of the most predominant real world crash conditions. The 30/15 mph velocity combination represents a crash severity associated with a 15 percent probability of sustaining a serious-to-fatal thorax injury. Therefore, this test condition is realistic.

Countermeasures designed for the 30 mph/15 mph condition will likely have positive effectiveness over the range of impact speeds. For example, as noted above, available data indicate the same countermeasure effectiveness at delta V's from 13.3 mph to 21.2 mph. The purpose of proposed side impact requirements is to prevent serious injuries and fatalities, rather than to address minor injuries. If the agency selected too low a test speed, the countermeasures used by manufacturers might not be effective at the higher speeds where more serious injuries are likely. For example, if very soft padding were selected, the padding would likely "bottom out" in a moderate impact and provide little protection.

NHTSA also does not agree that the proposed test speed would lead to countermeasures that are inappropriate for older occupants. As discussed above, any padding that is added to a car to reduce TTI(d) would clearly be less stiff than the interior of the car door and make a contribution to improving occupant safety for persons of all ages.

Numerous commenters objected to the crabbed wheel test condition, arguing that a perpendicular MDB impact would be less complex and introduce less test variability. Commenters also indicated that a perpendicular impact would promote harmonization, since Europe and Japan are investigating that test condition.

GM stated that, based upon MVMA crash tests, the crabbed configuration does not affect dummy responses significantly. That company expressed concern that when the MDB strikes the test vehicle, it slides some distance along its side before appreciable deformation occurs. GM argued that in the interest of eliminating what it considered a needless artifact which compromised objectivity, a perpendicular impact collision simulation should be used.

Ford argued that the dynamic effects influencing the kinematics of the struck car resulting from the crabbed motion of the barrier happen only after the dummy's maximum accelerations have been recorded and have no effect on chest or pelvic acceleration or on chest compression. That commenter stated that uncrabbed perpendicular impact at 30 mph by the barrier would produce essentially the same results without the complication of accurately driving the barrier in crabbed motion. Ford also argued that eliminating the crabbed motion of the barrier would reduce test-to-test variability and promote international harmonization of side impact regulations, as well as simplify mathematical modeling of the crash test during vehicle design and development.

As indicated above, in typical real-world side impacts, both vehicles are moving. In order to make the proposed crash test as representative as possible, the agency wanted to simulate that condition. Recognizing the difficulties associated with having more than one vehicle moving in a crash test, the agency proposed a test that would represent that condition without requiring movement of both vehicles. Given that the test car remains stationary, the crabbed wheel test condition is more representative of real-world side impacts than a perpendicular test. In particular, the crabbed configuration produces longitudinal loading on the struck vehicle, as would happen if both vehicles were moving. Therefore,

NHTSA does not believe that this proposed test condition should be changed, absent strong reasons.

An additional reason to maintain the crabbed wheel condition is that it facilitates testing side impact protection for both the front and rear seating positions in a single test. If the MDB were used in a perpendicular mode, a smaller area of the target car would be struck, and separate tests might be needed to assess front and rear performance.

NHTSA is not persuaded from the comments that the crabbed wheel test is difficult to run or introduces significant variability. The procedural steps for running a crabbed wheel test or non-crabbed wheel test are essentially the same, and NHTSA and a number of manufacturers have successfully conducted crabbed wheel tests. Indeed, NHTSA is aware of over 100 side impact tests conducted around the world. The agency has little data to compare the variability of crabbed versus non-crabbed test conditions. However, the agency is satisfied with repeatability of the crabbed test condition. NHTSA notes that in May 1990, Ford provided data from a recently completed side impact crash test program conducted to evaluate variability in test results. The study consisted of crashing six similar Ford Taurus vehicles using the proposed dynamic test procedure, including crabbed wheels. The data show that the crabbed test procedure is very repeatable.

Ford stated that many test facilities, including its own, cannot pull a crabbed cart through its center of gravity during guided travel. That company stated that this creates a greater tendency for a crabbed cart to deviate from its assigned path during the coast phase, increasing impact point variability. However, NHTSA has not experienced this problem at any of its contractor facilities.

Some commenters suggested that NHTSA specify a different impact point, the R-point (projection of the dummy's H-point), which is used in the European test procedure. GM stated that the impact point proposed by NHTSA is one of many which could be selected that are similarly credible, and suggested that specification of the R-point would promote international harmonization. EEVC stated that the R-point was selected for the European test procedure based on an accident survey conducted in France. That commenter believed that the R-point would be the most effective in the United States as well.

NHTSA compared center line of the barrier and the proposed impact point in its procedure to the European R-point. The agency found that the European R-point was generally behind the center line of the barrier and the proposed impact point. Thus, if NHTSA were to specify the R-point as the impact point, with the crabbed procedure, the barrier would not engage the A-pillars of some vehicles and would not cause a full impact loading of the dummy.

The agency believes that its proposed impact point is well-justified. For a further discussion of the basis for the proposed point, see Chapter III, section A.8 of the FRIA. NHTSA agrees with GM that the proposed impact point is one of several which could have been selected. The agency does not believe that selecting the R-point would have any impact on international harmonization, given other more significant differences between the new Standard No. 214 test procedure and the European procedure. For example, harmonizing on the precise impact point would not provide any meaningful benefits when very different moving barriers are specified. In addition, different impact points may affect test results. Therefore, one reason not to change the impact point is that such a change could reduce the value of the many side impact tests which have been conducted to date, for compliance and other purposes. Since NHTSA does not see any reason to specify the R-point, it is not making that change.

NHTSA has decided to make one minor change to the proposed impact point. Since the impact point is based on the center line of the wheel base of the struck car, NHTSA is concerned that the impact point for cars with very long wheel bases might be too far toward the rear of the car. This could result in the front dummy/door impact occurring after the barrier has slid past the dummy, with the dummy not experiencing the full impact. The largest car NHTSA has tested in its side impact test program had a wheel base of 114 inches. For that vehicle, the impact point was 20 inches behind the front axle. For cars with wheelbases greater than 114 inches, the agency has decided to specify that the leading edge of the MDB make initial contact 20 inches behind the front axle. This will ensure that the impact point is not too far back, relative to the front seat.

Ford and BMW provided very different comments concerning impact point tolerance. Ford argued that impact point tolerance is very important since the test results are significantly affected by whether the MDB contacts or misses the A-pillar. That commenter stated that while the NPRM did not specify an impact point tolerance, other agency documents specify ± 3 inches. Ford argued that this should be reduced to ± 1 inch. According to that company, a ± 3 inch tolerance is believed to contribute to what it considers to be an unacceptable level of rear seat dummy response variability. Ford argued that a lower impact point tolerance could reduce test-to-test variability.

BMW argued for a larger impact point tolerance, on the order of magnitude of ± 5 inches. That commenter stated that the MDB, because its wheels are

crabbed and it is accelerated on a long path, cannot realistically be exactly aligned with the impact point at the moment of impact due to yaw forces acting on the barrier during its acceleration run. BMW stated that this is especially true in view of the fact that the wheels must be individually adjusted to achieve a barrier orientation within a permitted tolerance of ±1°, with respect to the 27° impact angle.

As a general matter, NHTSA agrees with Ford that tolerances should be as small as possible, in order to keep variability as low as possible. In establishing tolerances, however, the agency must also take into account the fact that too small tolerances may have the effect of invalidating test results, if the actual impact point falls outside the specified tolerance. NHTSA has reviewed recently-conducted testing and believes that a tolerance of ±2 inches is readily obtainable with current testing protocol. In response to Ford's comment, the agency has therefore decided to specify a tolerance of ±2 inches, instead of ±3 inches. This tolerance is set forth in section S6.12. The agency is not adopting a higher tolerance, as suggested by BMW, because a higher tolerance would unnecessarily increase test variability. The agency is not adopting a tolerance as low as ±1 inch, as suggested by Ford, because such a low tolerance could be difficult to meet and could have the effect of invalidating test results.

GM expressed concern that impact point repeatability may be difficult to achieve because MDB tracking is influenced by tire pressure. According to that company, the MDB tends to bounce to one side of the tow system when the tire pressure exceeds 30 psi. GM stated that this could result in the center of the MDB striking the vehicle at a point more than four inches away from the intended impact point. That company did not provide any data in support of its concern about this issue.

NHTSA notes that one of the MDB assembly drawings specifies that tire pressure is to be maintained at 32 psi. Except for the last few feet, the MDB's position relative to the struck vehicle is controlled by a rail. As discussed in the FRIA, the agency has conducted 28 full scale production vehicle tests, in addition to many research tests, with tires at 32 psi. The agency has not had difficulty achieving repeatability of the impact point. In addition, MVMA conducted 16 Ford LTD tests and Transport Canada conducted four tests using the agency's test procedure with tires at 32 psi without impact point variability problems. Given the agency's experience and that of MVMA and Transport Canada, and the lack of data in support of GM's position, NHTSA is not persuaded that there is a problem with respect to impact point variability.

B. Alternative Composite Test Procedure

In the NPRM, the agency noted that component test procedures may eventually be possible alternatives to full scale crash tests. The agency reviewed some of the work that has been conducted in this area and indicated that, while it believed the concept needs additional research, it encouraged the further development of this approach. NHTSA specifically solicited comments on this subject.

Numerous commenters, including U.S., European and Japanese manufacturers, argued that the agency should not adopt a full scale crash test but instead pursue a laboratory compliance procedure such as the European Composite Test Procedure (CTP). The CTP was developed by Volkswagen and proposed by CCMC in Europe. It is based on the concept of using a mathematical model to predict human response to vehicle crashes. The CTP utilizes a three-step quasi-static crush of the inner and outer side surfaces of a vehicle, combined with a lumped, two-mass computer model of the occupant to simulate the full scale crash and to predict injury risk.

Commenters argued that the CTP offers several advantages over a full scale crash test. These include potentially lower costs, the ability to use CTP early in the design process of a vehicle, and greater opportunity for harmonization.

After considering the comments, NHTSA believes that neither the CTP, nor a similar approach is appropriate for this rulemaking. The CTP is a relatively new test procedure that is still in its developmental and validation stages. NHTSA believes that it would take at least several years to complete the development, validation and evaluation of this approach. The pursuit of this approach as an alternative to the full scale crash test proposed by NHTSA would thus result in at least a several year delay in improved side impact protection, a consequence that the agency does not consider acceptable. Moreover, NHTSA believes that a full scale crash test is the best means of testing the real world performance of a vehicle.

C. Dummy Seating Procedure and Use of Safety Belts

NHTSA proposed detailed procedures for positioning the SID in crash tests. Among other things, the agency proposed that a test dummy be restrained during a test only if that dummy is located in a seating position that is equipped with an automatic safety belt. This provision was proposed because, although belt usage is increasing as a result of the passage of mandatory use laws and a growing awareness of safety on the part of consumers, restraint usage is unlikely to reach 100 percent. NHTSA indicated that it desired to assure protection for unrestrained occupants. The agency noted in the

NPRM that recent accident data analyses indicate that belt restraints may be somewhat beneficial in side impacts.

The agency also noted that the unrestrained dummy is generally propelled to the far side of the vehicle in a side impact test, thus creating the potential of causing the far side door to open. Leaving the dummy unrestrained would thus aid in evaluating the capability of the far side door to remain closed during a side impact crash. The agency specifically sought comments on whether and why compliance testing should be conducted with restrained or unrestrained dummies.

Numerous commenters argued that test dummies should be restrained whenever any type of safety belt is provided. Some commenters argued that safety belt use is a more representative test condition. Volvo argued that tests with belts would better simulate reality, noting that the PRIA estimated belt use to range between 40 and 70 percent in 1995. Honda commented that safety belt use is representative of recommended use conditions, that both government and manufacturers are strongly recommending usage of safety belts, and that many states now enforce mandatory use laws. Ford stated that testing with all dummies restrained is consistent with the widespread adoption of mandatory usage laws and other activities intended to encourage belt use in the United States. That company expressed concern that by testing without belts, NHTSA could send a message to consumers that belt use is unimportant. Ford also expressed concern that the proposed test condition encourages installation of automatic belts instead of air bags, since a test dummy would be restrained only in a seating position for which there is an automatic belt restraint.

Some commenters argued that leaving a test dummy unrestrained would, in any event, not have a significant effect on the injury criteria. Volvo stated that its testing shows that the belt is loaded late in the crash event at a time when the injury criteria maximum has already been reached. Austin Rover stated that the impact of the dummy on the far side of the vehicle would not likely cause the door to open, since the dummy does not strike the door with sufficient force to open a door which has not unlatched, and any other unlatching forces or accelerations would have diminished before the dummy had traveled across the vehicle.

Honda argued that use of the unrestrained dummy is not a satisfactory way to evaluate opening of the far side door. That company stated that the unrestrained dummy is not always propelled and does not always impact the far side door in a side impact test, and that it is unclear how the dummy impact affects door opening.

Ford commented that the use of the restraint system during testing reduces the potential for dummy damage resulting from adverse dummy kinematics after the dummy/car side interior interactions are completed. IIHS, however, argued that test dummies should not be restrained even for some types of automatic belts, since the usage of some such belts is relatively low.

After considering the comments, NHTSA has decided to specify use of all available belt restraints in side impact testing. The agency is persuaded that since the side impact test dummy accelerations used to calculate the TTI(d) and pelvic injury criteria occur before the belt system tightens to restrain the occupant, belt use or non-use does not make a significant difference with respect to the test criteria. The agency also believes that the use of all available safety belts is most consistent with its belt use policy and with state belt use laws. Finally, given increased belt usage, the agency believes that use of all available belts is more representative of the real world.

NHTSA received a number of other comments concerning the proposed dummy positioning procedure. GM stated that three of the proposed requirements cannot be met simultaneously. These include placing the adjustable seat back in the manufacturer's recommended position, keeping the dummy's head level, and resting the dummy's upper torso against the seat back. GM stated that, for its tests, it considered the most important requirement to be that the head remain level. It stated that to do this, the upper torso was placed against the seat back, and the seat back angle was adjusted until the dummy head was level.

NHTSA agrees that the three conditions cited by GM cannot be met simultaneously. The agency notes that keeping the dummy's head level was not included in the proposed dummy positioning procedure, as corrected in a *Federal Register* notice published on March 17, 1988 (53 FR 8782). Since the purpose of the dynamic side impact crash test procedure is to evaluate thoracic and pelvic protection, NHTSA believes that the pelvic angle is more important for assessing thoracic and pelvic protection than is a head leveling requirement. The agency therefore is not adopting the head leveling specification.

Ford commented that further clarification is needed concerning positioning of dummies in the rear seat. That company noted that, under the proposal, if possible, the rear dummy's midsagittal plane (i.e., a vertical plane through the center of the dummy) was to be the same distance outboard as the front dummy's midsagittal plane. If this condition could not be met, however, the rear dummy was to be positioned so that the outermost skin of its upper torso just touched the adjoining innermost surface of

the vehicle. Ford stated that this alternative would be impossible to meet in some cases, because the location of some rear seat armrests preclude positioning the dummy's upper torso against the upper quarter panel surface while still positioning the dummy's midsagittal plane vertically. Ford also stated that it is not clear whether the term "innermost surface" means the broad trim panel surface or a smaller, localized trim feature.

In response to Ford's comment, NHTSA has modified the rear dummy positioning procedure for situations where the rear dummy's midsagittal plane cannot be positioned the same distance outboard as the front dummy's midsagittal plane. The procedure now specifies that, in such situations, the test dummy is positioned so that some portion of the test dummy just touches, at or above the seat level, the side surface of the vehicle, such as the upper quarter panel, an armrest, or any interior trim (i.e., either the broad trim panel surface or a smaller, localized trim feature).

NHTSA notes that the proposed rear dummy positioning procedure was developed for bench seats and is not appropriate for bucket or contoured seats. The agency has added a procedure for rear bucket and contoured seats. The procedure is similar to that proposed for front bucket seats. It specifies that (1) the upper torso of the test dummy rests against the seat back, and (2) the midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket or contoured seat.

Several commenters raised concerns about whether there is sufficient room in the rear seats of some cars to position the SID according to the proposed requirements. Ford stated, with reference to specifications for positioning the dummy's torso, that it believes there may be current or future vehicles which cannot accommodate the specified dummy or the SAE–826 H-point device (i.e., the device that would be used to locate the H-point for positioning the dummy) in the rear seat. That company suggested that NHTSA develop an alternative test procedure or exempt such vehicles from the requirement for testing with a rear-seated dummy. Porsche, in objecting to including rear-seat dummies in the test procedure, commented that there is not enough room in some cars for the dummies to be placed or to be positioned correctly. BMW commented that in certain small cars (e.g., 2 + 2 coupes), a 50th percentile SID cannot be accommodated according to the proposed requirements, due to inadequate space, although a smaller occupant could utilize such a seating position.

Volkswagen stated that, in some small vehicles, it may not be possible to position the proposed dummy in the rear seat in a natural position even though the rear seats contain "designated seating positions" capable of accommodating a person at least as large as a 5th percentile adult female. Volkswagen provided photographs which it says show that the head of the SID placed in a current vehicle rear seat interferes with the roof when positioned according to the proposed procedure. It provided other photographs which it says show positions where the roof does not interfere with the head, but the dummy is still in an unnatural and unrealistic position and the H-point is not within the proposed limit.

NHTSA notes that in some vehicles where the roof has a steep slope, the dummy head may interfere with the roof. In such instances, the dummy head can be tilted so as to accommodate the test dummy without changing the specified orientation of the thorax midsagittal plane, or affecting the H-point. NHTSA does not believe that tilting the test dummy's head would have any impact on the ability of the dynamic side impact crash test procedure to evaluate thoracic and pelvic protection.

NHTSA has concluded, however, that there are a some sport cars with rear seating areas that are so small that the SID dummy cannot be accommodated according to the specified positioning procedures, even if the head is adjusted fore-aft. The agency attempted to position the SID dummy in two cars identified by manufacturers as having potential problems in this area: a Volkswagen Corrado and an Audi Coupe Quattro. While NHTSA did not have difficulty in positioning the SID dummy in the rear of the Audi Coupe Quattro, it could not position the SID dummy in the Volkswagen Corrado according to the specified procedures.

Since it is necessary that standards be appropriate for all vehicle types to which they apply, NHTSA has decided not to apply the rear seat requirements to vehicles which have rear seating areas that are so small that the SID dummy cannot be accommodated according to the specified positioning procedures.

Based on review of vehicle sales data, the agency believes that less than one-half of one percent of passenger cars cannot accommodate the SID dummy in the rear seats. These excluded seating areas account for less than one fatality per year. While a relatively small safety problem, and while not subject to the requirements of this rule, the agency, nevertheless, believes that these seating positions will have improved levels of crash protection as a result of its action. Based on analysis of laboratory crash test data, when a vehicle is designed to provide side crash protection to the front seat occupant, the countermeasures also enhance rear seat crash protection. This occurs because the crash environment is more severe for the front seat occupant compared to the rear seat occupant. Thus, countermeasures to provide protection for the front seat will also

enhance rear seat crash protection. Accordingly, the population of rear seat occupants in excluded vehicles, while small, will also benefit from the improved side crash protection required by this rule.

Volkswagen also commented that the rear seat dummy poses additional positioning problems which are unique to the rear seat. It stated that, in two-door vehicles, control of the dummy H-point is only possible on the in-board side. According to that commenter, the proposed positioning procedure does not specify from which side to control the H-point (or whether it should be controlled from both sides, which would in some cases be impracticable). Volkswagen stated that placing the one accessible side within the proposed H-point tolerance rotates the dummy and produces a variable and unreproducible seating position.

NHTSA assumes that the H-point would ordinarily be controlled from the outboard side. The agency has been able to control the H-point within the specified tolerance from the outboard side in its tests. However, the agency does not believe there is any reason that the H-point location cannot also be controlled from the inboard side, within the specified tolerance, if the test dummy is positioned correctly. Since NHTSA and manufacturers other than Volkswagen have been able to conduct a number of side impact tests without difficulties in controlling the H-point, the agency does not believe that it is a problem.

D. Variability

NHTSA has evaluated test procedure repeatability (same test replicated at the same site) and reproducibility (same test replicated at different sites). A certain amount of variability will always exist when different vehicles of the same make/model are subjected to a crash test. A portion of the variability is due to vehicle variability. Some variability can also result from aspects of the test procedure, including the dummy, the impact point, and the MDB honeycomb face. Because of test site variations (e.g., instrumentation), it is generally accepted that site-to-site test variability (non-reproducibility) is usually greater than the same site test variability (non-repeatability).

In the PRIA, the agency considered repeatability in terms of coefficients of variation (CV, the standard deviation divided by the mean) for available test data. As discussed in the PRIA, one set of tests relevant to repeatability was sponsored by MVMA. Sixteen full scale crash tests were conducted using 1985 Ford LTD's and NHTSA's side impact test procedure. While certain changes were made to the vehicles, and dummies were only placed in the front passenger seating position, the tests indicated that the repeatability of NHTSA's side impact test procedure was fully acceptable.

The PRIA also discussed the results of three matched sets of test data from NHTSA's full scale crash test series, two Chevrolet Citations, three Nissan Sentras and three Honda Civics.

Subsequent to issuance of the NPRM, the agency obtained additional test data relevant to repeatability, most of it from commenters. Some of the test results submitted by manufacturers are subject to claims of confidentiality.

Ford commented that, while few of the cars it has tested have been identical in their front seat configurations, it conducted tests of five compact 2-door, five mid-size 4-door and four mid-size 2-door vehicles (14 cars total) which had identical rear seat configurations and were tested in an identical manner. As discussed below, Ford cited data for these 14 cars in arguing that rear seat test dummy TTI(d) is extremely unpredictable. In light of its concerns about variability, Ford subsequently crashed six similar Ford Taurus vehicles using the proposed test procedure, as a controlled repeatability test program to estimate front and rear variability, and provided the results to the agency.

As part of an effort to assess the full scale test comparability of SID and BioSID, MVMA crashed 12 model year 1990 Pontiac 6000's, alternating the BioSID and SID in the front and rear seat positions, as well as in baseline and padded test conditions. The SID data from these tests are relevant to the repeatability of the proposed test procedure.

GM and Mercedes-Benz each submitted data for two vehicles of the same model. The agency also has data for three other pairs of cars, where one was tested by NHTSA and the other by the manufacturer.

Ford tested 14 cars, five 2-door compacts, five 4-door mid-size vehicles, and four 2-door mid-size vehicles. For the three vehicles classes, the CV for rear seat TTI(d) ranged from 17.0 to 23.1 percent (and averaged 20.4 percent). The CV for rear seat pelvic g's ranged from 7.0 to 14.2 percent (and averaged 11.3 percent). Ford stated that because of the unpredictability of the rear seat dummy responses, it has serious concerns about being able to comply with the proposed requirements. That company argued that it would have to design its vehicles to achieve values well below the requirements of the standard to have reasonable confidence that production vehicles would pass compliance tests. Ford claimed, for example, that if NHTSA establishes an 85 TTI(d) limit, Ford would have to design the rear seats of their vehicles to achieve a TTI(d) level of 52 to ensure that the vehicle, if tested, would comply at the 20.4 percent variability that Ford has identified for the rear seat test dummy response. That company expressed concern that under these

circumstances, it could not meet the proposed requirements with reasonable and practicable design changes to its product line. Ford also stated that in focusing on variability at the rear seating position, it did not mean to imply that it was satisfied that the test procedure is capable of producing adequately predictable test result measurements for the front seat dummy.

NHTSA notes that the Department addressed the issue of repeatability at length in its rulemaking adding automatic crash protection requirements for passenger cars to Standard No. 208, Occupant Crash Protection. See 49 FR 28962, 29004–29006 (July 17, 1984). Like the proposed side impact requirements, the Standard No. 208 requirements involve a full scale crash test using instrumented test dummies. The standard requires that the head injury criterion (HIC), calculated from measurements taken on the dummy, not exceed 1,000.

Ford's arguments about excessive variability in the proposed side impact test procedure are similar to the arguments made by manufacturers in the Standard No. 208 rulemaking. As discussed in the July 1984 notice adopting the current version of Standard No. 208, auto manufacturers argued that because large test result differences are encountered in repeated tests of the same car, they cannot be certain that all their production vehicles would be in compliance even when their development tests show passing results. The manufacturers argued that the test result variances are essentially due to deficiencies in the test procedures themselves as well as in the prescribed test dummy. They also argued that the only way they could assure compliance is to "overdesign" their vehicles, which they argued would result in excessive costs without safety benefit. The manufacturers argued that the standard was neither "objective" nor "practicable," citing several court decisions.

The Department concluded that Standard No. 208 was both objective and practicable, noting that manufacturers had not supplied data to support their claims of excessive test variability, nor demonstrated that the bulk of any variability is due to the test procedures and instruments and not due to vehicle-to-vehicle differences.

In their arguments on Standard No. 208, manufacturers cited NHTSA tests of 12 Chevrolet Citations under the agency's New Car Assessment Program (NCAP). The manufacturers focused on the CV of the driver HIC values—21 percent—and claimed that this was too large. They argued that with this large a CV, they would have to design their vehicles to achieve a HIC no higher than 560 to assure that 95 percent of their cars, when tested, would have HIC values below 1000.

The Department concluded that the manufacturers' argument was faulty. The Department noted that variability by itself is not a crucial factor for a manufacturer to be concerned about. Rather, it is the combination of variability and the mean (or average) value which can be cause for concern. Data showed that HIC's for both automatic belts and air bags would be sufficiently low as to make variability a moot issue for Standard No. 208.

The FRIA reassesses repeatability/reproducibility using the newly available data, as well as earlier data, where appropriate. Two data sets available to the agency were not used in the assessment: (1) NHTSA's Citation, Sentra, and Civic data and (2) Ford's data for five compact 2-door, five mid-size 4-door and four mid-size 2-door vehicles with identical rear seat configurations.

The three NHTSA data sets were not used because there were changes in the SID and the seating procedure between vehicle tests. These changes may have influenced the test results.

The Ford data sets (from the 14 cars) were not used because there were differences in front doors and front seats between tests. In order to be a reliable test of repeatability, the cars and test conditions must be identical, to the extent possible, for each test. NHTSA does not consider tests using cars with different front doors and different front seats to be valid repeatability tests for rear seat results, even if rear seat configurations are the same, since the differences in the front doors and front seats may affect the rear seat results. The agency therefore rejects the 20.4 percent CV figure cited by Ford as an estimate of rear seat TTI(d) variability.

Ford was aware that the 14 tests that it used to estimate variability were not identical, because the cars were different. However, Ford claimed that it examined the tested vehicles, the high-speed crash test films and electronically recorded data, for each of the 14 cars and found no evidence of vehicle performance differences, such as unusual structural deformation, that could have affected test-to-test variability. As indicated above, NHTSA does not accept the tests in question as valid repeatability tests, given the differences in the front doors and front seats. The agency also notes that even without unusual structural deformations, vehicle-to-vehicle differences that are not apparent from films can also cause differences in test results.

1. Front Seat Variability

As discussed in the FRIA, the MVMA data for model year 1985 Ford LTD's indicate that for front TTI(d) and front pelvic g's the maximum CV ranged from 0.6 to 9.4 percent. The MVMA data for three baseline model year 1990 Pontiac 6000's indicate a CV of 9.15 percent for front TTI(d) and 8.38 for front pelvic g's. For three Pontiac 6000's with added

padding, the data indicate a CV of 7.78 percent for front TTI(d) and 5.84 percent for front pelvic g's. For the six Ford Tauruses tested by Ford, the data indicate a CV of 4.99 percent for front TTI(d) and 8.34 percent for front pelvic g's. All of the Pontiac 6000 tests were conducted at the same test site. The agency notes, however, that at least two SID dummies were used for the Pontiac 6000 tests, and at least four SID dummies made by two different manufacturers were used for the Taurus tests. Since different dummies are one of the differences that may exist between test sites, the use of different dummies helps demonstrate reproducibility.

The agency also has data for five pairs of other vehicles. The data were either provided in pairs or as a single test conducted under identical conditions to one performed by NHTSA. Two of the pairs involved tests conducted at the same test site. For two Mercedes-Benz's, the data indicate a CV of 0.65 percent for front TTI(d) and 6.17 percent for front pelvic g's. For another pair of vehicles, the CV figures are 0.00 percent and 10.34 percent, respectively.

The other three pairs involved tests at different test sites and are, therefore, useful for evaluating reproducibility. The front TTI(d) CV figures for these pairs are 1.14, 4.33 and 11.23 percent. The pelvic g's CV figures for these pairs are 5.00, 7.47 and 10.33 percent.

NHTSA believes the available data demonstrate high repeatability for front TTI(d) and front pelvic g's. As a general matter, the agency considers CV of less than 10 percent to demonstrate high repeatability. For the vehicle groups where there are more than two cars, the CV of both front TTI(d) and front pelvic g's are below 10 percent. For the pairs of vehicles, which represent more limited data sets, the CV of front TTI(d) and front pelvic g's is in several cases well below 10 percent and never significantly exceeds 10 percent.

2. Rear Seat Variability

As indicated above, the repeatability tests conducted by MVMA using model year 1985 Ford LTD's did not include any rear seat dummies. The MVMA data for three baseline model year 1990 Pontiac 6000's indicate CV of 8.19 percent for rear TTI(d) and 4.55 for rear pelvic g's. For three Pontiac 6000's with added padding, the data indicate a CV of 7.76 percent for rear TTI(d) and 16.52 percent for rear pelvic g's. For the six Ford Tauruses tested by Ford, the data indicate a CV of 6.32 percent for rear TTI(d) and 15.51 percent for rear pelvic g's.

The tests of the pair of Mercedes-Benz's did not include rear seat data. For the other pair of vehicles where testing was conducted at a single test site, the CV figures are 0.54 percent for rear TTI(d) and 0.27 percent for rear pelvic g's.

For the three pairs involving tests at different test sites, the rear TTI(d) CV figures are 0.80 percent, 12.56 percent, and 16.06 percent. The rear pelvic g's CV figures are 11.75 percent, 12.06 percent, and 13.65 percent.

NHTSA believes that available data indicate acceptable repeatability for rear TTI(d). For the three vehicle groups where there are more than two cars, the CV for rear TTI(d) is well under 10 percent. For the four pairs of vehicles, the CV for rear TTI(d) is well under 10 percent in two cases, somewhat above 10 percent in another case, and as high as 16 percent in the fourth case. In assessing repeatability, the agency places greater weight on the groups of vehicles with more than two cars ($n = 6$ for Ford Taurus and $n = 3$ for the two Pontiac 6000 groups), since a pair of vehicles ($n = 2$) represents an extremely limited data set. The agency notes that the 16 percent CV was measured for a single pair of vehicles and that there was a much lower CV for all of the other data sets. Given that the CV for rear TTI(d) is below 10 percent for all three vehicle groups, where there are more than two cars, and for two of the four pairs of vehicles, and that CV for the third pair is not very far above 10 percent, NHTSA considers rear TTI(d) variability to be very close to that for front TTI(d) and front pelvic g's.

NHTSA recognizes that repeatability appears to be somewhat lower for rear pelvic g's, but still considers it to be acceptable. While the CV was well below 10 percent for one of the three vehicle groups involving more than two cars, it was 15.51 percent and 16.52 percent for the other two vehicle groups. Also, while the CV was well below 10 percent for two of the four pairs of vehicles, it was 11.75 and 13.65 for the other two pairs. Based on the limited available data, it appears that while CV for front TTI(d), front pelvic g's, and rear TTI(d) are generally below 10 percent, CV for rear pelvic g's may sometimes be as high as 15 to 16 percent.

NHTSA has never attempted to quantify what represents acceptable variability versus unacceptable variability. In the Standard No. 208 rulemaking, the Department requested comments on what level of variability was deemed "reasonable," given that some variability will always exist. Only Renault provided a quantitative answer, saying that "the variation coefficient must not exceed a maximum of 10 percent." Although Renault provided no justification for its recommendation, the Department noted that it was nearly identical to the variation contributed by the Standard No. 208 test procedures and dummy, according to Volvo and GM.

NHTSA considers the repeatability for both side impact injury criteria measurements in both front

and rear seating positions to be acceptable. As discussed above, the agency believes that the available data indicate acceptable repeatability for front TTI(d), front pelvic g's, and rear TTI(d), as the available CV measurements for those three are, for the most part, below 10 percent. The agency believes that the available data indicate that the repeatability for rear pelvic g's is well within the acceptable range.

The agency also considered the repeatability data considered by the Department in the Standard No. 208 rulemaking. NHTSA notes that the CV for several groups of cars considered in that rulemaking were similar to or higher than the 15 to 16 percent CV experienced by some cars for rear pelvic g's. See Table III–7 of the Final Regulatory Impact Analysis for Standard No. 208, July 11, 1984. (While that table does not provide calculations of CV values, it does report the mean, standard deviation, and number of cars tested for each group, the terms from which CV is calculated.) Based on all available data, the agency considers the repeatability for both side impact injury criteria measurements in both front and rear seating positions to be similar to, or possibly better than, that considered and found acceptable by the Department for Standard No. 208. Moreover, manufacturers have now been complying with that standard's automatic crash protection requirements for several years, without any difficulties.

Given the above variability, NHTSA examined the practicability of the performance requirements adopted by this final rule, i.e., TTI(d) limits of 85 g for 4-door cars and 90 g for 2-door cars, with a pelvic acceleration limit of 130 g for all cars. Application of the effectiveness values set forth in the FRIA for various countermeasures to the 23 make/models used for estimating benefits indicates that the TTI(d) and pelvic g values can be brought below the limits being established in this final rule.

In light of Ford's particular concern about rear dummy variability, and the fact that available data indicate greater variability for the rear than the front (especially for pelvic g's), NHTSA also examined the relationship between the front and rear dummy responses. Based on NHTSA's 28 full scale tests, rear pelvic acceleration was 25 g's lower on average than front pelvic acceleration, and rear TTI(d) was 14 g's lower on average than front TTI(d). The agency believes these data indicate that it is easier to achieve lower pelvic g's and TTI(d) in the rear than in the front, which reduces the impact of the somewhat higher variability.

Finally, as was the case in the Standard No. 208 rulemaking, manufacturers have not demonstrated that the bulk of variability for any of the side impact criteria for the front and rear seating positions is due to the test procedures and instruments as opposed to vehicle-to-vehicle differences.

E. Test Surface

NHTSA also received a comment concerning specification of the test surface. GM argued that specification of the coefficient of friction of the tire/road interface is important for full scale vehicle crash tests, but was not specified by NHTSA in the NPRM.

NHTSA does not agree that a coefficient of friction must be specified in the regulation since the side impact crash forces greatly exceed the magnitude of tire/road sliding friction forces. Thus, variations in the coefficient of friction would have an insignificant or minor impact compared to other factors. For example, one load cell barrier test using the NHTSA MDB at 25 mph and a 26 degree crabbed impact angle produced a barrier face resultant load of 84,679 pounds. Assuming a sliding coefficient of 0.50, the lateral friction forces on the 3,000 pound car would be 1,500 pounds. In this example, the crash force level is over 50 times higher than the tire/road friction forces for the struck vehicle. Even if the MDB-to-car resultant force were less than than that load cell resultant force (e.g., about 60,000 pounds), this force level would still be many times greater than the tire/road friction forces.

Further, the side impact crash sequence takes place in a small fraction of a second, and is over before the vehicle motion relative to the "driving" surface occurs. As a result, the friction forces have an insignificant effect on the test dummy measurements.

NHTSA concludes that the tire/road friction forces are an insignificant or minor effect in side impact crash testing. When compared to crash forces, they are negligible across the full range of peak and sliding coefficients of friction. For the above reasons, NHTSA does not believe that the coefficient of friction of the test surface needs to be specified in the rule.

VII. International Harmonization

As the automotive industry has become an increasingly worldwide industry, interest in harmonized safety standards has increased. With harmonized standards, manufacturers can more easily build the same product to sell in different parts of the world, and cost savings can be achieved in areas of vehicle design, production, inventory, and certification.

Many commenters expressed concern that the proposed side impact dynamic crash test requirements are substantially different than those being developed in Europe. Those commenters argued that NHTSA should give greater weight to harmonization.

NHTSA is committed to international harmonization where practical. As in other areas, NHTSA has considered the issue of harmonization for this rule-

making. The agency notes that the United States has generally been ahead of Europe in the area of dynamic side impact test requirements, both in terms of developing a dynamic side impact test procedure, and now in adopting a regulation based on that procedure.

NHTSA notes that harmonization would likely have been easier had Europe not developed a different test dummy, different barriers, and a different injury criterion than those developed in the United States. The agency has, however, carefully considered the European approach to determine whether it would be appropriate for a Federal motor vehicle safety standard.

One concern NHTSA has about the European approach is that the two European barriers are not representative of the striking vehicles in side impact crashes in the United States. The European barriers appear to be more representative of the lighter and smaller European passenger cars. As discussed in the separate notice on the MDB, the NHTSA MDB is representative of passenger cars and light trucks that are likely to be the striking vehicle in side impact collisions in the United States. In order to ensure that the new side impact dynamic crash test requirements result in appropriate countermeasures, and hence reduced fatalities and injuries in the real world, NHTSA believes the MDB should be representative of striking vehicles in the United States rather than representative of vehicles used in other nations.

NHTSA also notes that there are a number of characteristics associated with the European test procedure that make it inappropriate, at this time, for a U.S. safety standard. The European test dummy (EuroSID), while capable of assessing injury potential and providing insight into side impact crash occupant protection, needs further refinement before it can be used as a regulatory tool. These ongoing efforts include the development of biofidelity response corridors to assure the EuroSID responds in a human-like manner, the evaluation of the repeatability and reproducibility of the test dummy, and the demonstration of its durability in full-scale crash tests. The EuroSID is progressing in all of these areas. Additionally, the urethane foam face of the European barrier appears to break down and bottom out, creating unexpectedly high dummy acceleration responses due to the unrealistic crash conditions it imposes. Further, it is still unclear whether Europe itself will adopt side impact requirements based on a full scale dynamic crash test.

NHTSA remains committed to international harmonization where practical. However, NHTSA believes that pursuit of harmonization as an alternative to the proposed requirements would result in at least a several year delay in improved side impact protection, a consequence that the agency does not consider acceptable. For all of the above reasons, NHTSA does not believe that harmonization considerations should preclude the agency from issuing a final rule based on its proposal. However, as Europe continues to develops its side impact standards and test procedures, NHTSA will consider whether further rulemaking is appropriate.

VIII. Feasibility of "Countermeasures"

As discussed in the NPRM, NHTSA has performed a substantial number of vehicle crash tests both to examine the existing side impact performance of many cars, as evidenced by measurements of the TTI(d) and pelvic acceleration on the side impact test dummy, and to evaluate the effectiveness of various techniques ("countermeasures") to improve side impact performance. In particular, the research programs have concentrated on making production-feasible structural changes and adding additional padding to the interior surface of the vehicle's side door to improve side impact protection. As discussed in more detail below, this research has shown that either the use of structural modifications in combination with padding or the use of padding alone can significantly reduce the probability of thoracic and pelvic injuries.

The following discussion highlights several of the more important side impact research programs conducted by NHTSA. The details of these and other agency research programs are discussed more fully in the PRIA and FRIA. In 1977, NHTSA began a program to improve the side structure integrity for lightweight subcompact cars, using a 2-door Volkswagen Rabbit. The agency decided to concentrate its research efforts on light vehicles, because it anticipated having the greatest difficulty in improving the level of side impact protection in those vehicles. The agency also believed that any countermeasures developed for those vehicles could be adapted for use in larger and heavier vehicles. NHTSA chose the VW Rabbit after testing the side impact performance of three small front wheel drive vehicles. The peak thoracic and pelvic accelerations measured on the side impact test dummy seated in the Rabbit indicated the Rabbit to be an "average" performer in its class.

The research program, involving the Budd Company, developed four levels of structural modifications to the 2-door VW Rabbit, to investigate the effect of increased side strength on intrusion. Those levels were categorized by the weight that the modifications added to the car and were designated as lightweight, middleweight, heavyweight and "optimized" (the "optimized" version used parts that had performed well in tests of the three other designs, but had been reduced in weight). These structural

additions focused on the front seat area; no structure was added to the rear quarter panel or in the C-pillar areas. Intrusion was reduced by a factor of nearly 50 percent (from approximately 20 inches to 10 inches) with the heavy and optimized weight designs, but the dummy peak accelerations were not significantly altered.

Concurrently with its programs to improve structural integrity, NHTSA also conducted research at its Vehicle Research and Test Center in East Liberty, Ohio to select and evaluate interior padding. The interior padding was an "add-on" feature, so that the door structure did not require alteration to accommodate the padding. The agency assumed that manufacturers would incorporate these features in production vehicles by using the door structure itself and part of the door thickness so as to minimize the space taken from the occupant compartment.

In January 1981, NHTSA began another research effort, which was conducted in two parts. This was called the modified integrated vehicle (MIV) program. One part was conducted by VW to improve the side impact protection of a 4-door VW Rabbit and the other part was conducted by MCR Technology Inc., using the Chevrolet Citation. The program evaluated both structural modifications and padding changes, independently and in combination. The first phase of the research effort concentrated on developing "production feasible" improvements, which would add little weight to the vehicle. To evaluate the performance of the modifications, the agency conducted a series of tests on the Rabbit simulating a vehicle moving at 22 mph striking another vehicle moving at 11 mph. The impact angle was 60 degrees. The agency's MDB was used as the striking vehicle. These tests involved an unmodified VW Rabbit, a structurally unmodified Rabbit with additional interior padding, a structurally modified Rabbit with no additional interior padding, and finally, a structurally modified Rabbit with additional interior padding.

In the second phase of the MIV program, the agency tested the structurally modified and padded Rabbit in two additional impact configurations. The configurations simulated a vehicle moving at 30 mph striking another vehicle moving at 15 mph at impact angles of 60 degrees and 90 degrees. In these tests, a Chevrolet Citation was used as the striking vehicle. The results of these tests are discussed in the FRIA.

In summary, NHTSA's testing shows that it is possible to develop "production feasible" countermeasures that can reduce potential thorax and pelvic injuries in side impacts. Based on the results obtained in this testing, NHTSA has, as discussed below, developed estimates of the effectiveness of different side impact countermeasures in reducing injuries.

IX. Estimate of Portion of the Vehicle Fleet Needing Improvement to Achieve Compliance

NHTSA explained in the NPRM that, in addition to the testing which was done on the modified and unmodified Rabbits and Citations, the agency had also conducted a series of 20 tests on 12 different unmodified production passenger cars. The PRIA used the results from the tests of the production vehicles to estimate the percentage of the passenger car fleet that currently meets the proposed alternative levels of the standard.

After issuing the NPRM, the agency conducted eight additional production vehicle tests, using eight different models. One model was also tested by Transport Canada. In addition, the agency received test data on 25 additional models from four different motor vehicle manufacturers. The FRIA uses only data from the more recently designed models (model year 1984 and later) to estimate what percent of the fleet currently meets alternative side impact performance levels. There are data available on 23 models: 10 2-door models and 13 4-door models.

In assessing the changes needed in current vehicles to meet the standard, the agency has not calculated the effectiveness of modifications that only involve structural changes. There were six cases of comparable baseline versus "structure alone" tests. In three of these tests for the driver, the TTI(d) went up and in three tests, the TTI(d) went down. A number of other tests have shown relatively little or no benefit from structure alone countermeasures. Because of these results, the agency does not consider the structural countermeasure it developed to be a consistent means of reducing side impact injuries. This does not mean that countermeasures using only structural modifications will not work. It simply means that the approaches evaluated by the agency did not consistently work.

Table 3 shows the percentage of the current new model passenger car fleet that meets the various alternative levels of TTI(d) at different seating positions in a car. For additional explanation of the data underlying Table 3 and the other tables presented in this section, see Chapter III, Section C of the FRIA.

Table 4 presents estimates of the percentage of the fleet that would need various countermeasures to meet the alternative levels of TTI(d). The percentage of the fleet is derived by assuming the effectiveness of the countermeasures as follows: for drivers—padding is approximately 21 percent effective (i.e., padding reduces TTI(d) by 21 percent), structure and padding is about 30 percent effective, and heavyweight structure and padding is 43 percent effective. For rear passengers, padding alone is assumed to be

TABLE 3
PERCENT OF THE FLEET MEETING
ALTERNATIVE TTI(d) LEVELS

	Driver			Rear Passenger		
TTI(d)	2-Dr.	4-Dr.	Total	2-Dr.	4-Dr.	Total
80	0.0%	61.5%	34.8	30.0%	53.8%	43.5%
85	10.0	69.2	43.5	40.0	61.5	52.2
90	10.0	84.6	52.2	50.0	69.2	60.9
95	10.0	84.6	52.2	50.0	92.3	73.9
100	20.0	100.0	65.2	50.0	100.0	78.3
105	20.0	100.0	65.2	70.0	100.0	87.0
110	70.0	100.0	87.0	70.0	100.0	87.0
115	90.0	100.0	95.7	80.0	100.0	91.3

35 percent effective. The agency derived these effectiveness estimates from its research on the performance improvements resulting from the use of various side impact protection countermeasures in cars. The agency then applied these effectiveness estimates to the TTI(d) values obtained for each of the 23 production cars that were tested to determine which countermeasure would be needed for each vehicle at the alternative TTI(d) levels proposed for the standard.

Table 5 indicates the estimated percentage of the current fleet meeting various alternative standards for pelvic g's.

Table 6 presents the percentage of the fleet that would need padding to meet the alternative levels of the pelvic g's standard being analyzed. Since for drivers, padding alone is approximately 35 percent effective, there is no need for any additional countermeasure. Similarly, for rear passengers, padding alone is approximately 33 percent effective, which is sufficient to meet the standard for all cars at all of the proposed pelvic g levels.

X. Costs

As a part of its research program on side impacts, NHTSA has done several major studies of the potential costs associated with improving side impact protection. The first cost study was based on work begun in 1980 with the Budd Company to develop several structural modifications for improving the side impact design of subcompact two-door sedans. As discussed earlier in this notice, the Budd Company developed four alternative side structure designs based on the 1976/1977 VW Rabbit two-door passenger sedan. The production version VW Rabbit was used as a baseline for comparing the weight, cost, and crash impact performance of the four modified design versions.

The four design concepts were categorized by the total added weight of the modifications to the car and were designated as a lightweight design, middleweight design, heavyweight design and an "optimized" design. The crash test results for the lightweight and middleweight designs showed that none of the structural modifications described above sufficiently improved side impact protection as measured by reductions in thoracic acceleration. The heavyweight and optimized designs showed promise of reducing side impact injuries and, consequently, the agency used those designs in calculating the costs associated with this rulemaking.

Subsequent to Budd's completion of this work, NHTSA sponsored several studies to analyze the costs and manufacturing feasibility of structural modifications and increased padding to improve side impact protection. These studies have concentrated on examining approaches that involve vehicle construction techniques and sophisticated tools used in efficient high-volume production. These studies found that the vehicle modifications examined by the agency could be simplified if a vehicle manufacturer planned to incorporate side impact protection features into a new vehicle design. In particular, the studies found that many of the parts used in the agency's original research program could be modified, combined, eliminated, or incorporated into a vehicle's basic structural members.

In addition to examining the costs of structural improvements, the agency has also analyzed the costs associated with the addition of padding. Both the costs and the weight changes derived from the modified vehicle tests conducted several years ago represent relatively high values. The primary purpose of the modifications tested was to reduce side door intrusion. However, as discussed above, the test results showed that structural improvements alone did not necessarily result in significant reductions in thoracic acceleration, as measured by TTI(d).

The agency believes that a more effective and efficient approach for reducing occupant thorax and pelvis injury in side impacts is to provide "equivalent padding" (either actual padding or modified, energy-absorbing sheet-metal structure) as neces-

TABLE 4
PERCENT OF THE FLEET NEEDING VARIOUS COUNTERMEASURES TO MEET ALTERNATIVE TTI(d) LEVELS

Two-Door Models

	DRIVER				REAR PASSENGER		
TTI(d)	NONE	PADDING	STRUCTURE & PADDING	HEAVYWEIGHT STRUCTURE & PADDING	NONE	PADDING	STRUCTURE & PADDING
80	0.0%	20.0%	70.0%	10.0%	30.0%	60.0%	10.0%
85	10.0	20.0	70.0	0.0	40.0	50.0	10.0
90	10.0	80.0	10.0	0.0	50.0	40.0	10.0
95	10.0	90.0	0.0	0.0	50.0	50.0	0.0
100	20.0	80.0	0.0	0.0	50.0	50.0	0.0
105	20.0	80.0	0.0	0.0	70.0	30.0	0.0
110	70.0	30.0	0.0	0.0	70.0	30.0	0.0
115	90.0	10.0	0.0	0.0	80.0	20.0	0.0

Four-Door Models

	DRIVER				REAR PASSENGER		
TTI(d)	NONE	PADDING	STRUCTURE & PADDING	HEAVYWEIGHT STRUCTURE & PADDING	NONE	PADDING	STRUCTURE & PADDING
80	61.5%	38.5%	0.0%	0.0%	53.8%	46.2%	0.0%
85	69.2	30.8	0.0	0.0	61.5	38.5	0.0
90	84.6	15.4	0.0	0.0	69.2	30.8	0.0
95	84.6	15.4	0.0	0.0	92.3	7.7	0.0
100	100.0	0.0	0.0	0.0	100.0	0.0	0.0
105	100.0	0.0	0.0	0.0	100.0	0.0	0.0
110	100.0	0.0	0.0	0.0	100.0	0.0	0.0
115	100.0	0.0	0.0	0.0	100.0	0.0	0.0

Combined Fleet

	DRIVER				REAR PASSENGER		
TTI(d)	NONE	PADDING	STRUCTURE & PADDING	HEAVYWEIGHT STRUCTURE & PADDING	NONE	PADDING	STRUCTURE & PADDING
80	34.8%	26.1	34.8%	4.3%	43.5%	52.2%	4.3%
85	43.5	21.7	34.8	0.0	52.2	43.5	4.3
90	52.2	43.5	4.3	0.0	60.9	34.8	4.3
95	52.2	47.8	0.0	0.0	73.9	26.1	0.0
100	65.2	34.8	0.0	0.0	78.3	21.7	0.0
105	65.2	34.8	0.0	0.0	87.0	13.0	0.0
110	87.0	13.0	0.0	0.0	87.0	13.0	0.0
115	95.7	4.3	0.0	0.0	91.3	8.7	0.0

TABLE 5
PERCENT OF FLEET MEETING
ALTERNATIVE LEVELS FOR PELVIC ACCELERATION

	Driver			Rear Passenger		
Level	2-Dr.	4-Dr.	Weighted Total	2-Dr.	4-Dr.	Weighted Total
130	30.0	91.7	63.6	80.0	69.2	78.3
150	60.0	100.0	81.8	90.0	92.3	95.7
170	90.0	100.0	95.5	100.0	92.3	95.7
190	100.0	100.0	100.0	100.0	92.3	95.7

sary in the door area. This should be more cost-effective than making structural changes for these types of injuries. This has been demonstrated by actual production vehicles. For example, the 1987 Nissan Sentra incorporated significant improvements, at a cost of apparently less than $100 per vehicle over the earlier version of this model, to improve considerably both the frontal and side impact safety performance of the vehicle. Also, there are some cars tested by NHTSA that already have relatively good side impact performance for the driver (e.g., Spectrum 2-door with TTI(d) of 83.5 g, Caprice 4-door with TTI(d) of 57.5. Since a number of cars demonstrate very good side impact performance without adding special countermeasures, the agency believes that other vehicles could also be redesigned to improve performance at lower increases in consumer costs than shown in the analysis.

TABLE 6
PERCENT OF FLEET NEEDING PADDING
TO MEET ALTERNATIVE LEVELS
OF THE STANDARD FOR PELVIC ACCELERATION

Two-Door Models

	DRIVER		REAR PASSENGER	
Pelvic g's	NONE	PADDING	NONE	PADDING
130	30.0%	70.0%	80.0%	20.0%
150	60.0	40.0	90.0	10.0
170	90.0	10.0	100.0	0.0
190	100.0	0.0	100.0	0.0

Four-Door Models

	DRIVER		REAR PASSENGER	
Pelvic g's	NONE	PADDING	NONE	PADDING
130	91.7%	8.3%	69.2%	30.8%
150	100.0	0.0	92.3	7.7
170	100.0	0.0	92.3	7.7
190	100.0	0.0	92.3	7.7

Combined Fleet

	DRIVER		REAR PASSENGER	
Pelvic g's	NONE	PADDING	NONE	PADDING
130	63.6%	36.4%	78.3%	21.7%
150	81.8	18.2	95.7	4.3
170	95.5	4.5	95.7	4.3
190	100.0	0.0	95.7	4.3

NHTSA has combined the estimates of the vehicle modification costs, including the fuel economy and secondary weight costs, associated with different types of side impact protection modifications, and the estimates of the percentage of the fleet that would need modifications to meet various thorax and pelvis acceleration levels. These total costs are summarized in Table 7. For additional explanation of the data underlying Table 7, see Chapter V of the FRIA.

The actual costs of the new requirements are expected to be lower than the estimates shown in Table 7, which are derived from the agency's somewhat outdated cost studies. The NHTSA tests showed that some existing vehicles could meet various levels of side impact safety performance with little modification. This suggests there are less costly ways of upgrading side impact protection.

Considering that most of the vehicles NHTSA has tested are not likely to be in the fleet 5 years after implementation of the final rule when the standard becomes fully effective, and that a phase-in schedule is being established, the agency believes that it is reasonable to assume that manufacturers would incorporate side impact safety improvements in the "clean-sheet design" of their new vehicle models to comply with the standard before or at the time of full implementation. This approach will likely entail research and development, engineering, and testing expenses in order to meet the standard, but perhaps, with a lessened variable cost per vehicle than the approach of making improvements to existing models.

NHTSA notes that its estimate of the average cost to achieve improved side impact crash protection does not apply to every vehicle. The agency-determined countermeasures required to achieve a specific level of improved side impact crash protection depends on the level of protection in the current production car and its overall design. As would be expected, the cost and complexity to achieve a specific level is typically greater for current production vehicles with higher levels of TTI. The agency established the TTI levels in the rule based on balancing the safety benefits of improving side impact crash protection with the practicability of the countermeasures necessary to achieve the improvement.

The agency has not designed and tested countermeasures to prevent door openings during the compliance tests. Thus, specific cost estimates for measures to meet this provision are not available. However, based on its November 1982 evaluation of Standard No. 214, the agency believes that reductions in the possibility of door openings are feasible through structural improvements made to reduce the TTI(d) and pelvic g's. The 1982 evaluation found that the inclusion of side door beams reduced the incidence of door openings by 20–40 percent in single vehicle crashes and by 10–30 percent in multi-vehicle crashes. The agency believes that further reductions are possible as a by-product of measures adopted to comply with the injury criteria. Thus, the costs of reducing door openings are believed to be included in the above-mentioned costs, or, in the alternative, are estimated to be relatively small, on the order of $2–$4 per vehicle affected. It is estimated that only a small portion of the fleet would be so affected.

Ford commented that NHTSA assumed incorrectly in the NPRM that, because some current cars "nearly" meet the proposed requirements, it will be relatively easy and inexpensive to adapt other cars to meet the proposed regulation simply by copying the thick door designs of the cars that nearly meet the requirements. That commenter stated that, based on an extensive test program, it believes that compliance with the proposed requirements will be neither easy nor inexpensive. Ford argued further

TABLE 7
ESTIMATED COST SUMMARY
FRONT AND REAR SEAT OCCUPANTS—COMBINED FLEET

	Total Vehicle Cost In 1989 $ Including Lifetime Fuel Cost Penalties (Without Secondary Weight Effects)	Total Vehicle Cost In 1989 $ Including Lifetime Fuel Cost Penalties (With Secondary Weight Effects)
	Per-Car Weighted Average	
80	$83.5	$120.8
85	72.4	104.8
90	35.2	48.6
95	17.0	22.2
100	13.2	17.2
105	11.7	15.0
110	5.8	7.6
115	2.7	3.6

that "thicker doors" are not a practicable design solution for side impact protection in smaller, i.e., subcompact and compact, passenger cars.

Ford noted that it has conducted 24 full vehicle side impact crash tests and has participated in numerous similar tests conducted by MVMA. That company stated that when test-to-test variability is considered, vehicles must be designed to meet a TTI(d) of no more than 69 to be reasonably confident that a production vehicle, tested at random, would achieve a TTI(d) of 85 or less. Ford stated that only four of 24 Ford tests resulted in a TTI(d) of 69 or less. That commenter also stated that available test data indicate that dummy accelerations measured in small cars are substantially higher than those measured in large cars.

Ford stated that, based on its current knowledge, it has very low confidence of being able to achieve TTI(d)'s in the 80 to 100 range in its small cars in the foreseeable future (six years or less). That company stated that it does not know what design countermeasures can be used in a small car to attain such TTI(d) values without unacceptably increasing the car's width and/or decreasing its interior space. Ford also stated that the high variability in test data provided by the rear seat in small cars makes it questionable whether Ford could ever have high confidence in rear seat compliance test results for small cars. Ford stated that it was unable to comment accurately on the agency's cost and weight estimates until designs were identified for each of its car lines that could meet the various levels of TTI(d) and pelvic acceleration specified in the proposal. It indicated, however, that it believed the agency's cost estimates were low.

NHTSA notes that Ford's comment bears on a number of issues that are separately discussed in this notice. That company's concern about variability is discussed above in the section on test procedure repeatability. Ford's comment also bears on feasibility of the methods of compliance, on the agency's estimate of the portion of the vehicle fleet needing improvement to achieve compliance, and on costs. For convenience, the agency is responding to Ford's comment concerning these latter issues together.

As discussed above, NHTSA engaged in significant side impact research programs to make "production feasible" structural changes and add additional padding to the interior surface of a vehicle's side door to improve side impact protection. The program concentrated on small cars, because the agency anticipated that it would be particularly difficult to improve the level of side impact protection in those vehicles.

The results of the agency's research program were discussed in the NPRM and documented in detail in the PRIA. Among other things, the data presented in the PRIA indicate that TTI(d) and pelvic g levels below the limits established in this final rule can be achieved for small cars. See, for example, the data for modified Volkswagen Rabbits. Ford did not discuss the agency's extensive research program in its comments. Since NHTSA believes that its research program clearly demonstrated the feasibility of the "countermeasures" to meet the new side impact requirements, for small cars as well as large cars, it does not agree with the concerns expressed by Ford in this area.

Ford further asserted that it must design vehicles to meet a TTI(d) of no more than 69 to be reasonably confident that a production vehicle, tested at random, would achieve a TTI(d) of 85 or less. The agency notes that it is customary for a manufacturer to account for variation in a vehicle's design in any case where a specific test value must be met. The specific design values will vary among vehicles and among manufacturers. As discussed above in the section on repeatability, manufacturers have not demonstrated that they cannot obtain sufficiently low front/rear TTI(d) and pelvic g values as to eliminate concerns about variability. Moreover, application of the effectiveness values cited by the FRIA for various countermeasures to the 23 make/models used for estimating benefits indicates that the front/rear TTI(d) and pelvic g values can be reduced below the limits being established in this final rule.

The agency notes that to the extent that manufacturers design to levels below the specified limits, an additional number of vehicles could be affected by design changes. This could result in somewhat greater costs. However, there would also be additional benefits, since benefits continue to accrue at TTI(d) and pelvic g levels below the specified limits.

In addition to the costs associated with designing and producing the countermeasures needed to meet the new performance requirements, today's rule will also result in some test equipment costs. The SID dummy is basically a Part 572 dummy with a modified thorax that uses thoracic and pelvic acceleration to measure impact loads. A SID dummy purchased new costs $26,250. This does not include approximately $6,000 of instrumentation, bringing the total cost to $32,250.

In addition to the cost of the dummy, there are costs associated with calibrating the dummy, purchasing replacement parts and performing the dynamic crash test. NHTSA estimates the total incremental cost per dummy per test application to be approximately $3,490. In addition, the estimated cost of the NHTSA MDB is approximately $26,200 with instrumentation. This does not include the expendable aluminum honeycomb face and bumper. This item currently must be replaced after each test and is estimated to cost approximately $1,700, if purchased in quantities of 60 or more.

XI. Consumer Reaction to Side Door Padding

The PRIA reported the results of a study conducted to evaluate consumer reaction to side door padding. The study tested driver performance in both baseline Volkswagen Rabbits and Rabbits with increased side padding. In addition, the drivers in the study were asked about comfort. A survey was also taken of potential car buyers concerning the acceptability of additional padding. The PRIA concluded, in view of the existing limited data, that the majority of the population in smaller than average cars will be able to drive normally and ride in comfort with up to three inches of additional padding. The PRIA further concluded that consumers would accept the concept of such increased side door padding.

Several commenters raised issues concerning the representativeness of the test car and the drivers. As discussed in the FRIA, NHTSA believes that the Volkswagen Rabbit was reasonably representative and that the agency did a reasonable job of testing with individuals who are likely to have the most difficulty with additional padding, and that the conclusion that up to three inches of padding will not affect driving performance for most individuals is accurate.

XII. Selection of TTI(d) and Pelvic Acceleration Limits

NHTSA proposed a fairly wide range of values for side impact performance criteria. For TTI(d), the agency proposed a range of 80 to 115. For pelvic acceleration, the agency proposed a range of 130 to 190 g.

The Insurance Institute for Highway Safety (IIHS) urged NHTSA to adopt a TTI(d) limit of 80, stating that the agency's analysis indicated that TTI(d) of 80 would have a much greater effect than TTI(d) of 85 in reducing severe injuries and deaths. With respect to pelvic acceleration, that organization stated that the agency should not set a limit that would allow a significant degradation in existing performance. That commenter stated that a review of NHTSA's crash tests shows that the measured pelvic accelerations in unmodified production cars varied widely, with many accelerations exceeding the upper range proposed by the agency. However, IIHS also contended that the test data show that existing production cars can meet pelvic acceleration limits of less than 90 g's. IIHS recommended that NHTSA set a pelvic acceleration limit toward the lower end of the 90 to 130 g's range.

The Center for Auto Safety and Public Citizen (CFAS/PC) urged NHTSA to set limits for both TTI(d) and pelvic acceleration below the levels of the ranges proposed by the agency. Those organizations recommended an initial TTI(d) limit of 70, which they contend NHTSA's research has demonstrated to be feasible, and also recommended that the limit be reduced to 60 in two years. CFAS/PC recommended a pelvic acceleration limit of 90 g's, which they also believe NHTSA has demonstrated to be feasible.

Greater reductions in fatalities and serious injuries are associated with more stringent (lower) limits on TTI(d) and pelvic acceleration. Since the purpose of this rulemaking is to address the serious side impact safety problem, NHTSA generally favors lower, as opposed to higher, TTI(d) and pelvic acceleration limits. However, in selecting specific values for the final rule, the agency must consider both the increased costs associated with more stringent requirements *and* the technological feasibility of achieving lower limits for all subject cars.

In determining the appropriate levels for a final rule, the agency has specifically analyzed four combined alternatives for the thorax and pelvis, all of which represent TTI(d) and pelvic acceleration values at the lower ends of the proposed ranges.

The first alternative is TTI(d) = 80 and pelvic g's = 130. These are the most stringent values proposed by NHTSA. The FRIA estimates that 31.8 percent of all cars currently meet these levels at the driver's position. Only one out of the 23 models tested would need heavyweight structure and padding modification to meet these levels.

The second alternative is TTI(d) = 85 and pelvic g's = 130. The FRIA estimates that the TTI(d) level of 85 is currently being met by 36.4 percent of the fleet at the driver's position. No existing cars would need heavyweight structure and padding to achieve 85 TTI(d).

The third alternative is TTI(d) = 90 and pelvic g's = 130. The FRIA estimates that the TTI(d) level of 90 is currently being met by 40.9 percent of all cars at the driver's position. Most cars can achieve this level using only padding.

The fourth alternative is TTI(d) = 95 and pelvic g's = 150. The TTI(d) level of 95 can be achieved with padding alone by all cars. A pelvic g limit of 150 is currently being met by 81.8 percent of the cars at the driver's position and 95.7 percent of the cars at the rear passenger position.

The agency's estimates of costs and benefits for the four alternatives are presented in Tables 8 through 10. For a further explanation of the data underlying these tables, see Chapter VII of the FRIA.

In considering alternatives, NHTSA notes that there are large differences in cost as the TTI(d) level decreases. The largest difference in TTI(d) is from 90 g to 85 g. This occurs because about 70 percent of the two-door models need structure and padding to

TABLE 8
COSTS AND BENEFITS OF COMBINATIONS OF ALTERNATIVES
(1989 Dollars)
TWO-DOORS AND FOUR-DOORS COMBINED

FRONT AND REAR SEATS COMBINED

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	736	3,390	$ 83.5	$120.8
2. 85	130	581	2,900	$ 72.4	$104.8
3. 90	130	444	2,415	$ 35.2	$ 48.6
4. 95	150	326	1,522	$ 17.0	$ 22.2

FRONT SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	654	3,071	$ 66.6	$ 97.2
2. 85	130	521	2,657	$ 56.2	$ 82.3
3. 90	130	399	2,244	$ 20.7	$ 28.2
4. 95	150	291	1,401	$ 12.4	$ 16.1

REAR SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	82	319	$ 16.9	$ 23.7
2. 85	130	60	243	$ 16.2	$ 22.7
3. 90	130	45	171	$ 14.5	$ 20.4
4. 95	150	35	121	$ 4.6	$ 6.1

*/Note: Included in the AIS 3–5 totals are AIS 2 pelvic fractures.

TABLE 9
COSTS AND BENEFITS OF COMBINATIONS OF ALTERNATIVES
(1989 Dollars)
TWO-DOORS

FRONT AND REAR SEATS COMBINED

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	510	2,658	$179.2	$263.7
2. 85	130	456	2,450	$155.4	$228.7
3. 90	130	387	2,186	$ 67.3	$ 94.3
4. 95	150	296	1,445	$ 35.6	$ 46.3

FRONT SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	459	2,451	$151.9	$224.5
2. 85	130	411	2,278	$129.9	$192.0
3. 90	130	347	2,047	$ 43.7	$ 60.1
4. 95	150	262	1,336	$ 26.3	$ 34.0

REAR SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	51	207	$ 27.3	$ 39.2
2. 85	130	45	172	$ 25.5	$ 36.7
3. 90	130	40	139	$ 23.6	$ 34.2
4. 95	150	34	109	$ 9.3	$ 12.3

*/Note: Included in the AIS 3–5 totals are AIS 2 pelvic fractures.

TABLE 10
COSTS AND BENEFITS OF COMBINATIONS OF ALTERNATIVES
(1989 Dollars)
FOUR-DOORS

FRONT AND REAR SEATS COMBINED

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	226	732	$ 19.7	$ 25.7
2. 85	130	125	450	$ 17.1	$ 22.4
3. 90	130	57	229	$ 13.8	$ 18.1
4. 95	150	30	77	$ 4.7	$ 6.1

FRONT SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	195	620	$ 9.7	$ 12.4
2. 85	130	110	379	$ 7.1	$ 9.1
3. 90	130	52	197	$ 5.3	$ 6.9
4. 95	150	29	65	$ 3.2	$ 4.1

REAR SEATS

TTI(d)	Pel. g's	Benefits: Fatals	Benefits: AIS 3–5*	Costs per Vehicle: Without Secondary Weight	Costs per Vehicle: With Secondary Weight
1. 80	130	31	112	$ 10.0	$ 13.3
2. 85	130	15	71	$ 10.0	$ 13.3
3. 90	130	5	32	$ 8.5	$ 11.2
4. 95	150	1	12	$ 1.5	$ 2.2

*/Note: Included in the AIS 3–5 totals are AIS 2 pelvic fractures.

achieve 85 g, while only 10 percent need these countermeasures to achieve a TTI(d) of 90 g.

While costs increase as TTI(d) decreases, benefits also increase. Given the greater reductions in fatalities and serious injuries that occur as TTI decreases (e.g., benefits at TTI = 80 g include 736 fewer fatalities, as compared to 581 fewer fatalities at TTI = 85 g, and 444 fewer fatalities at TTI = 90 g), NHTSA favors the lower ends of the proposed ranges even after taking into account the higher costs.

Another important issue, however, is technological feasibility. In particular, based on its review of the record, NHTSA is concerned about the ability of manufacturers to achieve TTI(d) lower than 90 g for all of their two-door cars, and lower than 85 g for all of their four-door cars.

NHTSA believes that it is generally more difficult for manufacturers to achieve lower TTI(d) for two-door cars than for four-door cars. The reason for this is that the side structure and geometry of two-door cars is different from four-door cars. For example, since the door on a two-door model is typically wider than on a four-door model, it is more difficult to design as strong a structure for the door on the two-door model. Taking into account the confidential data submitted by the manufacturers and other available data, the agency has six sets of data on two-door and four-door versions of the same model. These data indicate that the driver dummy injury measurements in a two-door car are about 14 percent higher than in a four-door car. NHTSA also observes that of 22 two-door cars for which the agency has data, only one had driver TTI(d) less than 80 g, only two had less than 85 g, and only five had less than 90 g.

The agency also believes that variability should be taken into account in selecting performance limits. As discussed above in the section on repeatability, a certain amount of variability (both vehicle-to-vehicle variability and test procedure variability) will always exist when different vehicles of the same make/model are subjected to a crash test. Moreover, since each vehicle is required to meet a specified performance limit, it is normal for a manufacturer to account, in a vehicle's design, for such variation. While the specific design values will vary among vehicles and among manufacturers, vehicles will generally be designed to values somewhat below those specified by a particular standard.

The issue of variability is related to actual costs and benefits. As indicated above, to the extent that manufacturers design to levels below the specified limits, there could be somewhat greater costs. However, there would also be additional benefits, since benefits continue to accrue at TTI(d) and pelvic g levels below the specified limits.

NHTSA does not agree with CFAS/PC's argument (for TTI(d) and pelvic acceleration) and IIHS's argument (for pelvic acceleration) that the agency's research demonstrates that performance limits could be set far below the levels of the proposed ranges. In setting performance limits that must be met by all cars, the agency must consider all available data and not focus exclusively on test results for a very small number of cars. Also, since each car must meet a specified performance limit, the agency must take variability into account.

Based on its review of all available data, NHTSA has decided to adopt a TTI(d) limit of 85 g for 4-door cars and 90 g for 2-door cars. The pelvic acceleration limit is being set at 130 g for all cars. This represents a combination of the second and third alternatives discussed above. These requirements will result in significant safety benefits, and the agency is convinced that all cars can be designed to meet the requirements. The agency is not adopting less stringent requirements in view of the smaller benefits that would result. NHTSA believes the record does not justify setting more stringent requirements at this time, given uncertainties as to whether manufacturers could meet such requirements for all of their cars.

Given the possible additional safety benefits that could result from lower TTI(d) limits, however, NHTSA plans in the future to reevaluate the feasibility of lower TTI(d) limits. Both the agency and manufacturers will then have considerably more information about the countermeasures that can be used to improve side impact protection and their effectiveness. The agency therefore plans to conduct such an evaluation at that time.

NHTSA's estimates of costs and benefits for the performance requirements being adopted today are presented in Table 11. For a further explanation of the data underlying this table, see Chapter VII of the FRIA.

XIII. Inclusion of Rear Seat Performance Requirements

Numerous commenters argued that NHTSA should not include rear seat performance requirements in a final rule. The main reason cited by commenters relates to the low occupancy of rear seats, and hence to the lower benefits of rear seat as compared to front seat requirements. Toyota argued, for example, that studies of accident data demonstrate that of the total number of occupant side impact injuries, the percentage of rear seat occupants is small, and that it is therefore not cost-effective to require side impact protection in rear seats. Volkswagen stated that a NHTSA study of safety belt use indicated that the left rear and right rear seats in passenger cars are occupied in only 2.0 and 1.7 percent of trips by cars, respectively. That

TABLE 11
COSTS AND BENEFITS OF FINAL RULE
(1989 Dollars)

	BENEFITS		COSTS PER VEHICLE	
	Fatals	AIS 3–5*	Without Secondary Weight	With Secondary Weight
Total benefits (2-doors and 4-doors combined/ front and rear seats combined)	512	2,636	$37.1	$51.2
2-doors and 4-doors combined/front seats	457	2,426	$21.7	$29.5
2-doors and 4-doors combined/rear seats	55	210	$15.4	$21.7
2-doors/front and rear seats combined	387	2,186	$67.3	$94.3
2-doors/front seats	347	2,047	$43.7	$60.1
2-doors/rear seats	40	139	$23.6	$34.2
4-doors/front and rear seats combined	125	450	$17.1	$22.4
4-doors/front seats	110	379	$ 7.1	$ 9.1
4-doors/rear seats	15	71	$10.0	$13.3

*/Note: Included in the AIS 3–5 totals are AIS 2 pelvic fractures.

commenter stated that NHTSA has not identified or justified the rear seating position as requiring additional protection. Volkswagen expressed concern that a second dummy doubles the complexity of data collection and the potential for lost channels. That company also cited dummy positioning problems, a subject addressed above, as a reason to eliminate rear seat performance requirements. Rolls-Royce stated that the structural countermeasures provided for the front seating position are likely also to be effective for rear seats, and that the interior padding countermeasures required for the front compartment will most likely be similarly provided for the rear compartment, both as good engineering practice and for reasons of design symmetry and style.

NHTSA recognizes that the benefits of improved side impact performance are considerably lower for rear seats than front seats, given the low occupancy of rear seats. The costs are also lower, however. As indicated in Table 11, above, the costs per vehicle associated with the alternative requirements being adopted today are about $22 for front seats versus $15 for rear seats. (With secondary weight, the costs are about $30 and $22, respectively.) Moreover, NHTSA believes that the benefits associated with rear seat requirements are considerable, 55 fewer fatalities and 210 fewer serious-to-critical injuries each year. While Rolls-Royce speculates that manufacturers would provide similar protection in rear seats as for the front seats, such similar protection would not be ensured without requiring it in the final rule. The agency concludes that rear seat side impact performance requirements are justified.

XIV. Leadtime/Phase-in

The leadtime needed to meet the new side impact requirements varies depending upon what countermeasures are necessary for particular models. As discussed in the NPRM, for vehicles needing "padding only" countermeasures, NHTSA estimates that the normal leadtime to design, tool and test new interior trim panels and armrests is approximately 14 to 18 months. For vehicles requiring either structure and padding or heavyweight structure and padding, greater leadtime is required. In cases involving only relatively minor changes in design and tooling to the doors, "A" and "B" pillars, side rails, etc., needed leadtime probably will not exceed two years. However, some structure/padding upgrade designs may require complete new body structural designs. For these models, four to five years of leadtime may be necessary in order to minimize diversions of engineering resources from normal planned product decisions, interruption of planned new model changes, and retooling and production costs.

NHTSA stated in the NPRM that it believed that the best approach to addressing the varying leadtime requirements was to phase-in the standard. The agency noted that this would allow manufacturers that can use the relatively straightforward padding approach in some of their models to adopt that countermeasure in the early years of the phase-in, while providing sufficient time for manufacturers to design, develop, and produce significant structural modifications for those vehicles that need major changes.

NHTSA proposed that the new requirements be phased-in according to the following implementation schedule:

10 percent of all cars manufactured during the first full production year (September 1 to August 31) beginning more than 24 months after the issuance of the final rule;

25 percent of all cars manufactured during the second full year beginning after that 24-month period;

40 percent of all cars manufactured during the third full year after that 24-month period; and

100 percent of all cars manufactured on or after the beginning of the fourth full year after that 24-month period.

While the proposed regulatory text did not specify the terms of the phase-in, NHTSA indicated that it contemplated adding regulatory text along the lines used to adopt the phase-in of Standard No. 208, Occupant Crash Protection. The agency requested comments on that approach.

Manufacturers supported a phase-in. Ford recommended that provisions like those in Standard No. 208 relating to production volumes (see S4.1.3.2.2), carry-forward credits (see S4.1.3.4(b), (c) and (d)), and cars produced by more than one manufacturer (see S4.1.3.5) be adopted.

Honda argued that a longer phase-in should be provided. That commenter stated that it is not appropriate to apply the same phase-in as was specified for Standard No. 208, since neither NHTSA nor manufacturers have the experience regarding the determination of energy absorption and the relationship between the internal wall of the vehicle and the dummy that was available with respect to Standard No. 208. Honda suggested that at least one more step be provided in the phase-in.

Peugeot argued that the proposed phase-in schedule would in reality require those manufacturers who have only one model on the American market to comply in 100 percent of their vehicles sold in the first year of the phase-in, only two years after the final rule has been promulgated. That company stated that protection in side impacts is much more difficult to insure than in frontal impacts, because the available space to absorb the energy is smaller. Peugeot stated that, depending on the levels adopted for the proposed performance requirements, five years leadtime might be required. Peugeot suggested that an alternative phase-in schedule be provided for manufacturers which comply with 100 percent of their vehicles at initial application. Similar concerns were expressed by Austin Rover and Rolls-Royce.

NHTSA disagrees that a longer phase-in is needed than for Standard No. 208. While Honda argued that neither the agency nor manufacturers have as much experience in this area, NHTSA believes that its research program has sufficiently identified the kinds of countermeasures that are necessary to meet the new requirements. Further, the agency believes that the phase-in provides adequate time for manufacturers to add padding and make structural changes, as necessary, and to certify compliance for their vehicles.

NHTSA believes that the proposed phase-in schedule can be viewed as being not necessarily any more difficult for single line manufacturers than for large manufacturers. Since the proposed phase-in schedule requires at least 10 percent of a manufacturer's cars to comply with the new side impact requirement in the first year of the phase-in, in practice each manufacturer must bring at least one model into compliance for that year. Viewed in this way, the burden on a manufacturer with only one model in the U.S. market to bring one model into compliance for the first year may be regarded as not being any different than that of a manufacturer which sells many models. NHTSA further notes that the phase-in for Standard No. 208 had similar provisions and that manufacturers with a limited number of models in the U.S. market were able to comply with that Standard. No manufacturer provided evidence that it could not meet the proposed requirements for at least one model with two years leadtime.

On the other hand, the agency recognizes that a single model represents all of a single line manufacturer's production and only a small portion of a multi-line manufacturer's production. It also recognizes that a greater portion of a single line manufacturer's engineering expertise and other resources will be called upon to bring that single line into compliance than a multi-line manufacturer will have to use to achieve compliance for a single line. The same points are true, albeit to a lesser extent, for a multi-line foreign manufacturer importing only a single model line into the United States.

The agency has identified an alternative compliance schedule which it believes would help meet the concerns of single line manufacturers, while also being consistent with the need for motor vehicle safety. Under this option, a manufacturer would not need to meet the new requirements for any cars during the first year of the phase-in, but would then be required to meet the requirements for all of its cars beginning with the second year of the phase-in. A manufacturer choosing this option would thus have three years leadtime to meet the new requirements. While this option would be available to all manufacturers, the agency believes that it would not be feasible for the larger manufacturers to comply with it. NHTSA believes that the option would be consistent with the need for motor vehicle safety, since the number of cars meeting the new require-

ments during the three-year phase-in period would be considerably higher under this option than under the other schedule.

CFAS/PC argued that the proposed phase-in schedule is an example of NHTSA being "far too solicitous of the wishes of auto company managements and far too indifferent to the safety needs of the public." Those commenters questioned whether there needs to be any phase-in at all, stating that the agency has not made an adequate case for the lengthy phase-in it proposed. They also argued that if there is a phase-in, small and medium size cars should be phased in first since the fatality rates in side impact crashes for those cars is twice the fatality rate in large cars.

NHTSA notes that one reason a phase-in is appropriate is that most manufacturers have many models subject to the new requirements. These manufacturers must design and produce the necessary modifications to meet the new requirements for each of their models. However, the same engineering resources and testing facilities may be needed for all of the models, and cannot be used simultaneously. Given the complexity of the new side impact requirements, the agency believes that the length of the proposed phase-in is appropriate. With respect to CFAS/PC's suggestion that the requirements be phased in for smaller cars first, NHTSA notes that the requirements are generally more difficult to meet for small cars than large cars. If the requirements were phased in for smaller cars first, it might therefore be necessary to begin the phase-in at a later time. The agency believes it is appropriate to permit manufacturers flexibility in this area.

After considering the comments, NHTSA has decided to adopt the proposed phase-in schedule, while also providing the alternative compliance schedule discussed above. More specifically, each manufacturer's passenger cars manufactured on or after September 1, 1993, for sale in the United States, will have to meet the new side impact performance requirements based on the following phase-in schedule:

10 percent of automobiles manufactured during the 12 month period beginning September 1, 1993;

25 percent of automobiles manufactured during the 12 month period beginning September 1, 1994;

40 percent of automobiles manufactured during the 12 month period beginning September 1, 1995; and

All automobiles manufactured on or after September 1, 1996.

Under the alternative compliance schedule, no compliance will be required during the production year beginning September 1, 1993, but full implementation will be required effective September 1, 1994.

NHTSA notes that while the final rule establishes different TTI(d) limits for two-door cars and four-door cars, manufacturers need not meet the phase-in requirements separately for these two types of cars. For example, during the first year of the phase-in, a manufacturer does not need to have 10 percent of its two-door cars and 10 percent of its four-door cars meet the new requirements. The 10 percent requirement applies to the manufacturer's fleet as a whole, and could be met entirely by two-door cars or four-door cars, or by a combination of the two types of cars.

As suggested by Ford, the agency has included provisions similar to those in Standard No. 208 for production volumes and cars produced by more than one manufacturer. In cases where passenger cars are manufactured by two or more companies, manufacturers may determine, by contract, which of them will count such vehicles. Two rules of attribution apply in the absence of such a contract. First, a passenger car which is imported for purposes of resale is attributed to the importer, which will be responsible for meeting the percentage phase-in requirements and for making the necessary reports. This applies, of course, to both direct importers as well as importers authorized by the vehicle's original manufacturer. (In this context, direct importation refers to the importation of cars which are originally manufactured for sale outside the U.S. and which are then imported without the manufacturer's authorization into the U.S. by an importer for purposes of resale. The Vehicle Safety Act requires that such vehicles be brought into conformity with Federal motor vehicle safety standards.) Under the second attribution rule, a passenger car manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, is attributed to the manufacturer which markets the vehicle. These two attribution rules generally attribute a vehicle to the manufacturer which is most responsible for the existence of the vehicle in the United States, i.e., by importing the vehicle or by manufacturing the vehicle for its own account as part of a joint venture, and marketing the vehicle.

NHTSA has decided not to include provisions for carry-forward credits. For the Standard No. 208 phase-in, the agency decided that it would be appropriate to permit manufacturers that exceeded the minimum phase-in requirements in earlier years to "count" those extra vehicles toward meeting the minimum percentage requirements of later years. The agency concluded that such a credit would encourage the early introduction of larger numbers of automatic restraints. One difference between the Standard No. 208 phase-in and the side impact phase-in is that almost all cars needed the addition of automatic belts or air bags in order to meet Standard No. 208, while many vehicles do not need

any changes to meet the new side impact requirements. If carry-forward credit provisions were established for the side impact phase-in, manufacturers might be able to build up credits during the early years of the phase-in by using cars which already meet the standard and thereby avoid making the necessary changes to meet the full percentage requirements in the later years of the phase-in. For this particular rulemaking, the agency therefore concludes that carry-forward credit provisions would be inappropriate.

XV. Retention of Related Requirements in Standard No. 214 and Other Standards

In the NPRM, the agency requested comments on retaining the existing requirements of Standard No. 214 if the proposed new performance requirements were adopted. For many years, the standard has required each side door to resist crush forces that are applied by a piston pressing a steel cylinder against the door's outside surface in a laboratory test. NHTSA's research has shown that the existing requirements of the standard have been effective in reducing fatalities and injuries in single vehicle impacts. The agency believes that the primary reason for the effectiveness of the current standard is that it reduces intrusion in the vehicle. In particular, the added side door beam helps to keep a pole, tree, guardrail or other fixed object from intruding into the occupant's seating position and from hitting the occupant. Given the effectiveness of the existing requirements, the agency indicated that it contemplated retaining them.

Numerous commenters argued that the existing requirements of Standard No. 214 should be deleted as superfluous if dynamic test requirements become effective. Some commenters argued that the existing requirements are not the best means for addressing pole impacts. Commenters also suggested that the retention of the existing requirements might make it more difficult to meet the new requirements.

Ford argued that the existing Standard No. 214 provisions should be retained because they have proven effective in reducing injuries and fatalities resulting from single vehicle side impacts into poles and trees. That company stated that the proposed full vehicle crash testing does not address concentrated loading, such as by poles and trees, which account for approximately a quarter of side impacts. Ford also argued, however, that changes should be made in the existing requirements to make them more realistic.

After considering the comments, NHTSA has decided to retain the existing requirements of Standard No. 214. The agency concludes that the existing requirements have proven to be effective and to provide benefits in single vehicle crashes that would not necessarily be provided by the new dynamic requirements. NHTSA is not aware of any evidence indicating that compliance with the existing requirements will make it difficult to meet the new requirements. Moreover, those current models which already meet the new requirements also meet the existing requirements. NHTSA does not consider changes to the existing requirements or alternative ways of addressing pole impacts to be within the scope of the NPRM.

The NPRM also requested comments on whether to retain the requirements of Standard No. 201, Occupant Protection in Interior Impact, concerning armrests. That standard sets forth various requirements for armrests, including ones which require armrests to be constructed with energy-absorbing material.

Several commenters argued that it is unnecessary to retain the armrest requirements of Standard No. 201 once a dynamic side impact test requirement becomes effective. Those commenters argued that the armrest requirements would be duplicative.

After considering the comments, however, NHTSA has decided to retain the Standard No. 201 requirements. The new dynamic requirements primarily address hard thorax injuries, which include some, but not all abdominal injuries. NHTSA believes that the Standard No. 201 requirements provide benefits that might not be provided by the dynamic test requirements of Standard No. 214. As indicated above, the SID dummy was not designed with an abdominal load sensor. Therefore, the proposed test procedure might not pick up a concentrated load applied to the abdomen, such as might occur from an armrest impacting an occupant in a crash. NHTSA therefore believes that it is appropriate to continue to specify separate requirements for armrests to help ensure that they are not overly aggressive in crashes.

XVI. Limitation on Intrusion

In the NPRM, the agency requested comments on whether it should adopt a separate limitation on the intrusion that occurs during the proposed dynamic side impact test.

Manufacturers argued that the agency should not adopt a limitation on intrusion. Ford stated that compliance with the current Standard No. 214 test requirement and the proposed test requirements would inherently limit the amount of intrusion. That commenter argued that there is no need for an additional requirement that is design restrictive. Nissan stated that there is no need for superimposing an intrusion restriction upon that of dummy readings. That company stated that since NHTSA's real intent is to lower dummy readings, the manufacturers should be provided with design flexibility. Volvo stated that, according to its tests, the amount of intrusion does not directly translate to injuries

measured in the occupants. That commenter stated that it is the dynamic behavior of the deformation and the amount of intrusion during the first 30 milliseconds of the side impact crash that is of importance for the injury criteria levels and that it is not evident that the amount of residual deformation correlates to the dynamic event. Volvo expressed concern that adding a requirement on the amount of deformation could create a risk of sub-optimization for TTI(d) or pelvic G's. Austin Rover stated that a limit on intrusion would not serve a useful purpose. That company stated that the injuries sustained by occupants in the proposed test are due to the occupant being accelerated sideways by the inside surface of the vehicle. Austin Rover argued that injuries sustained by intrusion would more likely be caused by crushing the occupant between the side of the vehicle and some other fixed part of the vehicle. That commenter stated that in practice the intrusion seen in the test is not sufficient for this to occur.

IIHS noted that the agency had proposed to retain the existing crush resistance requirements of Standard No. 214, but urged NHTSA to supplement those requirements with an intrusion limit in the new barrier-into-car test. That commenter stated that the purpose of the intrusion limit should be to reduce the possibility of localized intrusion, which might cause penetrating injuries that would not be measured by the proposed TTI(d) performance criterion. The Center for Auto Safety and Public Citizen recommended that NHTSA specify a maximum intrusion distance such as the 18 inches in the present static standard which would protect against injuries not measured by the proposed TTI(d) or pelvic g's performance criteria.

After considering the comments, NHTSA has decided not to adopt a limitation on intrusion. The agency notes that an 18-inch limitation on intrusion would not appear to add any protection because intrusion is generally less than 18 inches in side impact tests using the proposed procedure. Localized intrusion does not occur in the test because the uniform MDB face loads the door laterally, as the MDB slides toward the rear, and there are no protruding structures on the barrier face to cause such intrusion. Moreover, intrusion in the dynamic side impact test has not been correlated to injury, and an intrusion limitation might not serve any purpose.

XVII. Stretch Limousines

Superior Coaches, an alteration manufacturer of limousines, expressed concern that the proposed requirements would result in economic hardship for it. That company indicated that it manufactures limousines by altering various makes of complete, certified passenger cars. All of the passenger cars are purchased as four-door sedans. The original vehicle is cut transversely behind the center pillar, and the underbody and roof construction are extended. Additional right and left center pillars and right and left side doors are added. Superior Coaches indicated that it altered several different models of cars and expressed concern that it would have to crash test each model.

NHTSA has considered whether it should apply the new dynamic crash requirements to stretch limousines. These vehicles differ from other passenger cars in two ways: (1) they are considerably longer, and (2) they have a variety of rear seating configurations.

The agency has concluded that the new requirements are appropriate for the front seats of stretch limousines. The front seats of these vehicles are no different than the front seats of other passenger cars. Moreover, the test procedure evaluates the side impact protection of the front seats in the same manner as for any other passenger car.

NHTSA has concluded that the test procedure is not appropriate for the rear seats of stretch limousines. After the stretching, the primary rear seats are typically so far back from the MDB impact point that the side impact protection provided for those seating positions cannot appropriately be evaluated by the test procedure. The variety of seating configurations provided in the rear of stretch limousines also make the test procedure inappropriate. NHTSA has therefore decided not to apply the rear seating requirements to passenger cars with a wheelbase greater than 130 inches. The agency notes that the wheelbases of the longest current production (i.e., unaltered) passenger cars are several inches shorter than 130 inches.

The agency estimates that there are about 40 alterers that modify production vehicles into stretch limousines. These alterers are generally small businesses.

Alterers are required to certify that the altered vehicle continues to comply with all applicable Federal motor vehicle safety standards. This should not create a significant burden on limousine manufacturers. First, the production cars used for limousines will be certified to comply with the new requirements before the alteration. Alterers will generally not remove padding from the front doors that might be provided in light of the requirements. Since stretch limousines generally have wheelbases longer than 130 inches, the rear seat requirements would not apply. Thus, alterers would not need to add any countermeasures to limousines to ensure that the vehicles would pass the new requirements. However, they would have to make certain, through conducting or sponsoring engineering analysis and/or testing as needed, that their alterations do not weaken

the front seat side impact protection provided by the original manufacturer.

Limousine manufacturers should already have considerable experience in certifying that their altered vehicles continue to comply with standards that specify crash test requirements, since several existing standards that include crash test requirements for passenger cars do not exclude limousines. These standards include Standard No. 203, Head Impact Protection for the Driver from the Steering Control System; Standard No. 204, Steering Control Rearward Displacement; Standard No. 208, Occupant Crash Protection; Standard No. 202, Windshield Mounting; Standard No. 219, Windshield Zone Intrusion; and Standard No. 301, Fuel System Integrity. NHTSA does not believe that it should be more burdensome for alterers to certify that their altered vehicles continue to meet the new side impact requirements than it is for them to certify that the vehicles continue to meet other standards which specify crash tests. This is particularly true with respect to Standard No. 301, which requires that vehicles pass a lateral moving barrier crash test.

XVIII. Regulatory Impacts

A. Executive Order 12291

NHTSA has examined the impact of this rulemaking action and determined that it is major within the meaning of Executive Order 12291, and significant within the meaning of the Department of Transportation's regulatory policies and procedures. The agency has prepared a Final Regulatory Impact Analysis describing the economic and other effects of this rulemaking action. The analysis is being placed in the docket.

B. Regulatory Flexibility Act

NHTSA has also considered the impacts of this rulemaking action under the Regulatory Flexibility Act. I hereby certify that it would not have a significant economic impact on a substantial number of small entities. Accordingly, the agency has not prepared a regulatory flexibility analysis.

The primary cost effect of this rule is on passenger car manufacturers. Few, if any, passenger car manufacturers would qualify as small entities.

NHTSA estimates that there are about 40 alterers that modify production passenger cars into stretch limousines. These alterers are generally small businesses. Alterers are required to certify that the altered vehicle continues to comply with all applicable Federal motor vehicle safety standards. As discussed above, this rule should not create a significant burden on limousine manufacturers. Alterers would not need to add any countermeasures to limousines to ensure that the vehicles would pass the new requirements. However, they would have to make certain, by conducting or sponsoring engineering analysis and/or testing as needed, that their alterations do not weaken the front seat side impact protection provided by the original manufacturer. The agency does not believe that it should be more burdensome for alterers to certify that their altered vehicles meet the new side impact requirements than it is for them to certify that the vehicles meet other applicable standards which specify crash tests.

Other manufacturers which would qualify as small entities, small organizations and governmental units would be affected by this rule to the extent that they purchase passenger cars. They will not be significantly affected, since the potential increases associated with this action should only slightly affect the purchase price of new motor vehicles.

PART 571—[AMENDED]

In consideration of the foregoing, 49 CFR Part 571 is amended as follows:

1. The authority citation for Part 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

2. Section 571.214 is amended by revising S1, S2, and S3 and adding S5 through S8.5.2 to read as follows:

§ 571.214 [Amended]

S1 *Scope and Purpose*

(a) *Scope.* This standard specifies performance requirements for protection of occupants in side impact crashes.

(b) *Purpose.* The purpose of this standard is to reduce the risk of serious and fatal injury to occupants of passenger cars in side impact crashes by specifying vehicle crashworthiness requirements in terms of accelerations measured on anthropomorphic dummies in test crashes, by specifying strength requirements for side doors, and by other means.

S2 *Application.* This standard applies to passenger cars.

S3 *Requirements.*

(a) Each vehicle shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2 when any of its side doors that can be used for occupant egress are tested according to S4.

(b) When tested under the conditions of S6, each passenger car manufactured on or after September 1, 1996 shall meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars

with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(c) Except as provided in paragraph (d) of this section, from September 1, 1993 to August 31, 1996, a specified percentage of each manufacturer's yearly passenger car production, as set forth in S8, shall, when tested under the conditions of S6, meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(d) A manufacturer may, at its option, comply with the requirements of this paragraph instead of paragraph (c) of this section. When tested under the conditions of S6, each passenger car manufactured from September 1, 1994 to August 31, 1996 shall meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

* * * * *

S5 *Dynamic performance requirements.*

S5.1 *Thorax.* The Thoracic Trauma Index (TTI(d)) shall not exceed 85 g for passenger cars with four side doors, and shall not exceed 90 g for passenger cars with two side doors, when calculated in accordance with the following formula:

$TTI(d) = 1/2\ (G_R + G_{LS})$

The term "G_R" is the greater of the peak accelerations of either the upper or lower rib, expressed in g's and the term "G_{LS}" is the lower spine (T12) peak acceleration, expressed in g's. The peak acceleration values are obtained in accordance with the procedure specified in S6.13.5.

S5.2 *Pelvis.* The peak lateral acceleration of the pelvis, as measured in accordance with S6.13.5, shall not exceed 130 g's.

S5.3 *Door opening.*

S5.3.1 Any side door, which is struck by the moving deformable barrier, shall not separate totally from the car.

S5.3.2 Any door (including a rear hatchback or tailgate), which is not struck by the moving deformable barrier, shall meet the following requirements:

S5.3.2.1 The door shall not disengage from the latched position;

S5.3.2.2 The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.

S5.3.2.3 Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

S6 *Test conditions.*

S6.1 *Test weight.* Each passenger car is loaded to its unloaded vehicle weight, plus its rated cargo and luggage capacity, secured in the luggage area, plus the weight of the necessary anthropomorphic test dummies. Any added test equipment is located away from impact areas in secure places in the vehicle. The car's fuel system is filled in accordance with the following procedure. With the test vehicle on a level surface, pump the fuel from the vehicle's fuel tank and then operate the engine until it stops. Then, add Stoddard solvent to the test vehicle's fuel tank in an amount which is equal to not less than 92 percent and not more than 94 percent of the fuel tank's usable capacity stated by the vehicle's manufacturer. In addition, add the amount of Stoddard solvent needed to fill the entire fuel system from the fuel tank through the engine's induction system.

S6.2 *Vehicle test attitude.* Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition. The "as delivered" condition is the vehicle as received at the test site, filled to 100 percent of all fluid capacities and with all tires inflated to the manufacturer's specifications listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's "fully loaded condition." The "fully loaded condition" is the test vehicle loaded in accordance with S6.1. The load placed in the cargo area is centered over the longitudinal centerline of the vehicle. The pretest vehicle attitude is equal to either the as delivered or fully loaded attitude or between the as delivered attitude and the fully loaded attitude.

S6.3 *Adjustable seats.* Adjustable seats are placed in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

S6.4 *Adjustable seat back placement.* Place adjustable seat backs in the manufacturer's nominal design riding position in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 25° from the vertical. Place each adjustable head restraint in its highest adjustment position. Position adjustable lumbar supports so that they are set in their released, i.e., full back position.

S6.5 *Adjustable steering wheels.* Adjustable steering controls are adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions.

S6.6 *Windows.* Movable vehicle windows and vents are placed in the fully closed position on the struck side of the vehicle.

S6.7 *Convertible tops.* Convertibles and open-body type vehicles have the top, if any, in place in the closed passenger compartment configuration.

S6.8 *Doors.* Doors, including any rear hatchback or tailgate, are fully closed and latched but not locked.

S6.9 *Transmission and brake engagement.* For a vehicle equipped with a manual transmission, the transmission is placed in second gear. For a vehicle equipped with an automatic transmission, the transmission is placed in neutral. For all vehicles, the parking brake is engaged.

S6.10 *Moving deformable barrier.* The moving deformable barrier conforms to the dimensions shown in Figure 1 and specified in Part 587.

S6.11 *Impact reference line.* For vehicles with a wheelbase of 114 inches or less, on the side of the vehicle that will be struck by the moving deformable barrier, place a vertical reference line which is 37 inches forward of the center of the vehicle's wheelbase. For vehicles with a wheelbase greater than 114 inches, on the side of the vehicle that will be struck by the moving deformable barrier, place a vertical reference line which is 20 inches rearward of the centerline of the vehicle's front axle.

S6.12 *Impact configuration.* The test vehicle (vehicle A in Figure 2) is stationary. The line of forward motion of the moving deformable barrier (vehicle B in Figure 2) forms an angle of 63 degrees with the centerline of the test vehicle. The longitudinal centerline of the moving deformable barrier is perpendicular to the longitudinal centerline of the test vehicle when the barrier strikes the test vehicle. In a test in which the test vehicle is to be struck on its left (right) side: all wheels of the moving deformable barrier are positioned at an angle of 27 ± 1 degrees to the right (left) of the centerline of the moving deformable barrier; and the left (right) forward edge of the moving deformable barrier is aligned so that a longitudinal plane tangent to that side passes through the impact reference line within a tolerance of ± 2 inches when the barrier strikes the test vehicle.

S6.13 *Anthropomorphic test dummies.*

S6.13.1 The anthropomorphic test dummies used for evaluation of a vehicle's side impact protection conform to the requirements of Subpart F of Part 572 of this Chapter. In a test in which the test vehicle is to be struck on its left side, each dummy is to be configured and instrumented to be struck on its left side, in accordance with Subpart F of Part 572. In a test in which the test vehicle is to be struck on its right side, each dummy is to be configured and instrumented to be struck on its right side, in accordance with Subpart F of Part 572.

S6.13.2 Each Part 572, Subpart F test dummy specified is clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the test dummy is equipped with a size 11EE shoe which meets the configuration size, sole, and heel thickness specifications of MIL–S–13192 (1976) and weighs 1.2 ± 0.2 pounds.

S6.13.3 Limb joints are set at between 1 and 2 g's. Leg joints are adjusted with the torso in the supine position.

S6.13.4 The stabilized temperature of the test dummy at the time of the side impact test shall be at any temperature between 66 degrees F. and 78 degrees F.

S6.13.5 The acceleration data from the accelerometers mounted on the ribs, spine and pelvis of the test dummy are processed with the FIR100 software specified in 49 CFR Part 572. The data are processed in the following manner:

S6.13.5.1 Filter the data with a 300 Hz, SAE Class 180 filter;

S6.13.5.2 Subsample the data to a 1600 Hz sampling rate;

S6.13.5.3 Remove the bias from the subsampled data, and

S6.13.5.4 Filter the data with the FIR100 software specified in 49 CFR Part 572, which has the following characteristics—

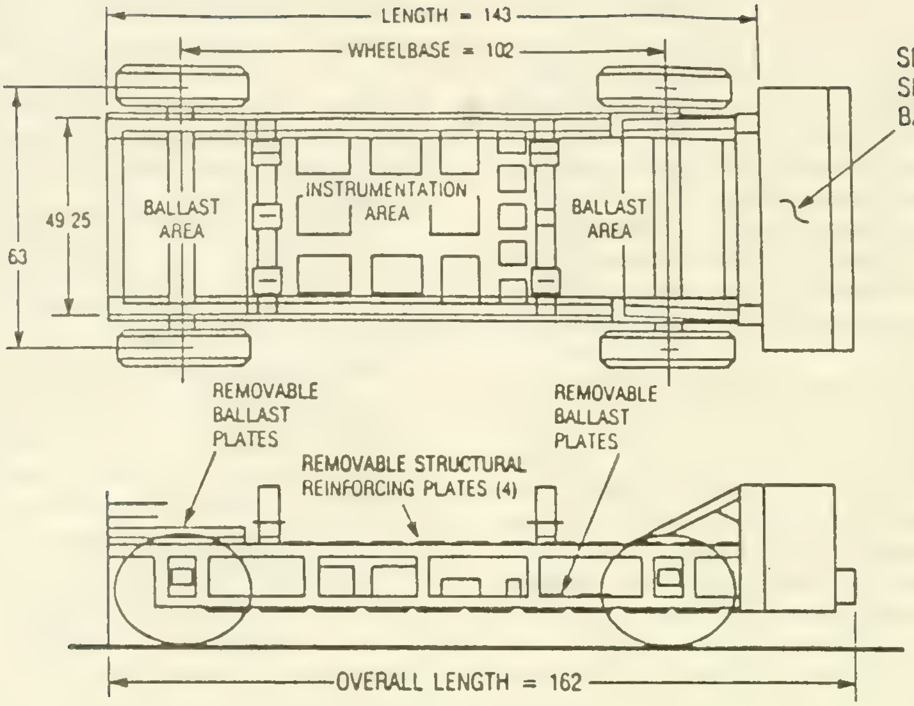
S6.13.5.4.1 Passband frequency 100 Hz.

S6.13.5.4.2 Stopband frequency 189 Hz.

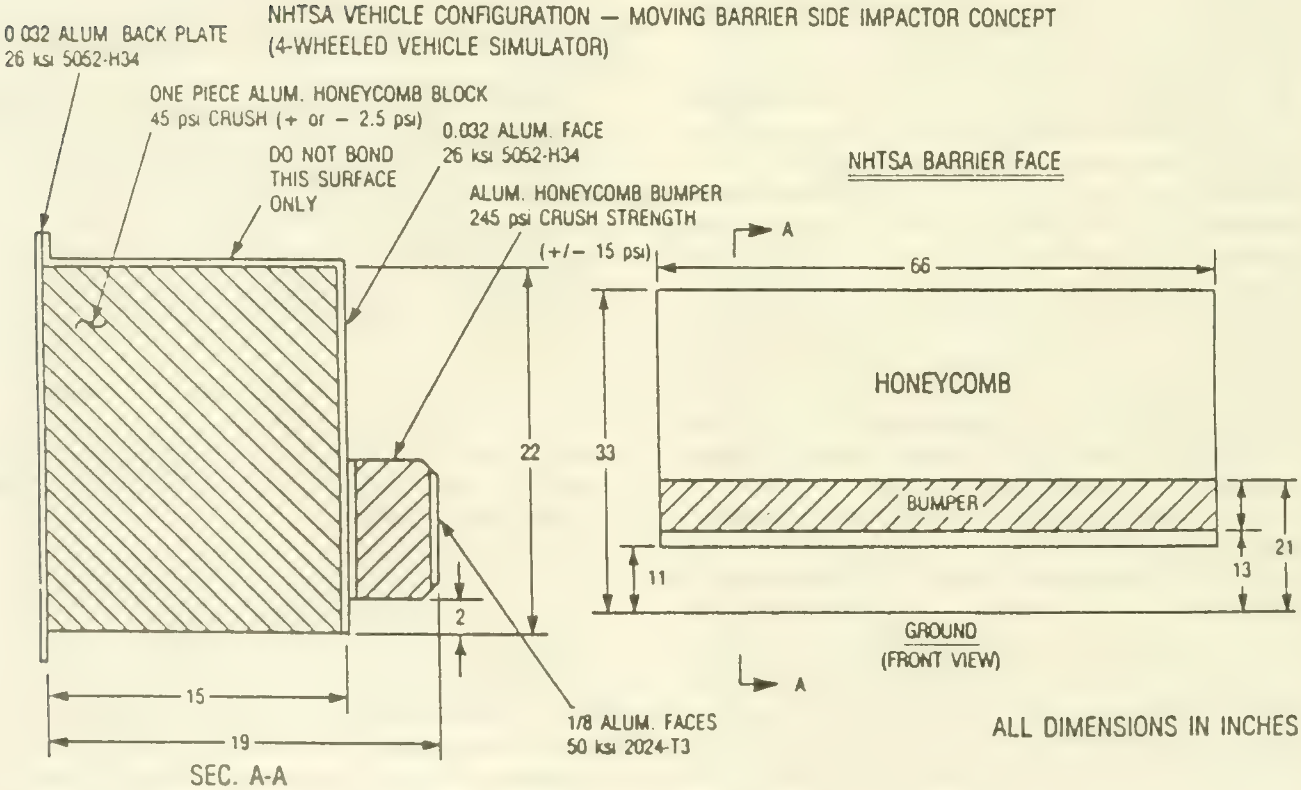
S6.13.5.4.3 Stopband gain −50 db.

S6.13.5.4.4 Passband ripple 0.0225 db.

S7. *Positioning procedure for the Part 572 Subpart F Test Dummy.* Position a correctly configured test dummy, conforming to Subpart F of Part 572 of this Chapter, in the front outboard seating position on the side of the test vehicle to be struck by the moving deformable barrier and position another conforming test dummy in the rear outboard position on the same side of the vehicle, as specified in S7.1 through S7.4. Each test dummy is restrained using all available belt systems in all seating positions where such

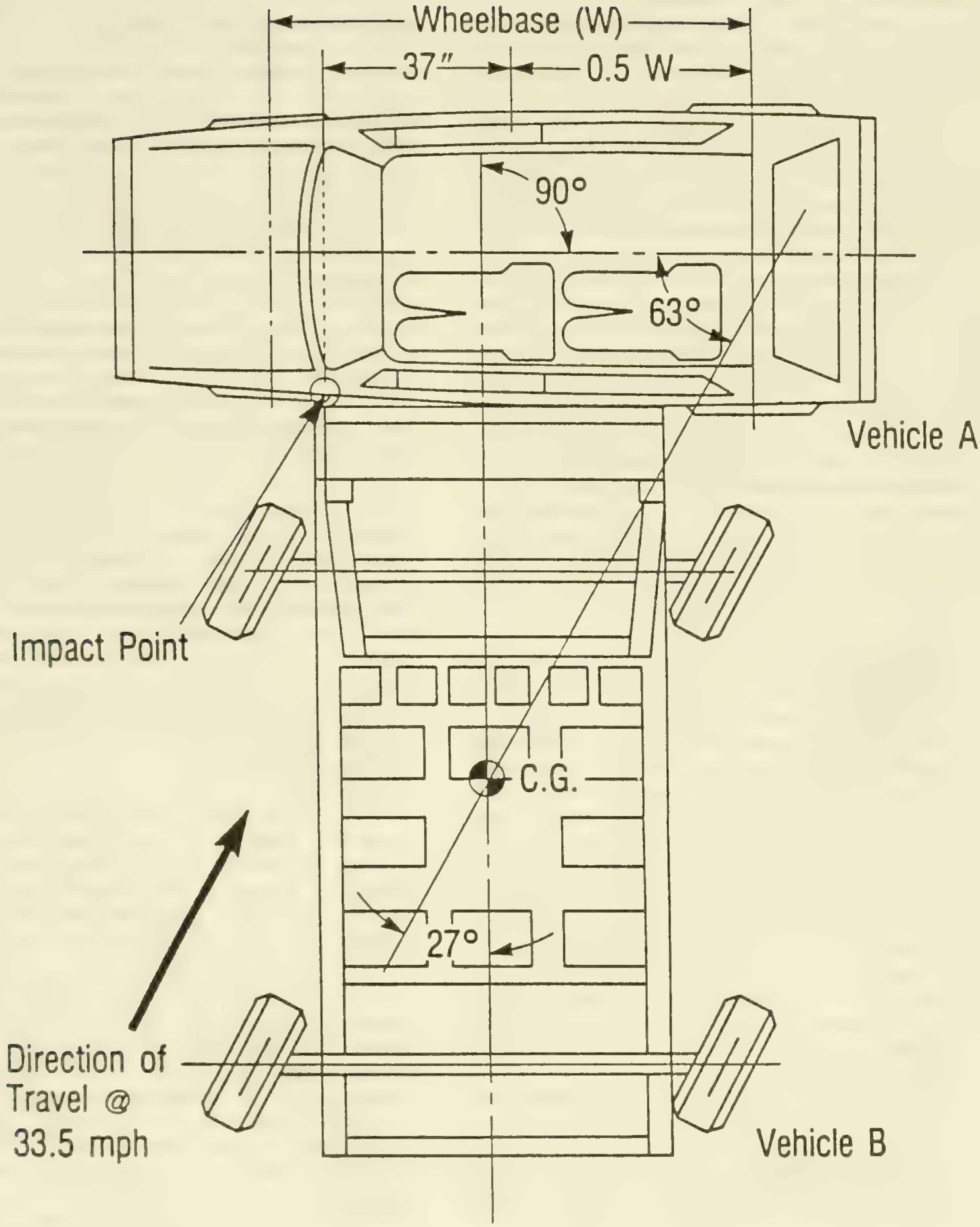


NHTSA VEHICLE CONFIGURATION — MOVING BARRIER SIDE IMPACTOR CONCEPT
(4-WHEELED VEHICLE SIMULATOR)



NHTSA Side Impactor—Moving Deformable Barrier

FIGURE 2



Test Configuration

FIGURE 3

belt restraints are provided. In addition, any folding armrest is retracted.

S7.1 *Torso.*

S7.1.1 *For a test dummy in the driver position.*

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and passes through the center of the steering wheel.

(b) *For a bucket seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket seat.

S7.1.2 *For a test dummy in the front outboard passenger position.*

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and the same distance from the vehicle's longitudinal centerline as would be the midsagittal plane of a test dummy positioned in the driver position under S7.1.1.

(b) *For a bucket seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket seat.

S7.1.3 *For a test dummy in either of the rear outboard passenger positions.*

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and, if possible, the same distance from the vehicle's longitudinal centerline as the midsagittal plane of a test dummy positioned in the driver position under S6.1.1. If it is not possible to position the test dummy so that its midsagittal plane is parallel to the vehicle longitudinal centerline and is at this distance from the vehicle's longitudinal centerline, the test dummy is positioned so that some portion of the test dummy just touches, at or above the seat level, the side surface of the vehicle, such as the upper quarter panel, an armrest, or any interior trim (i.e., either the broad trim panel surface or a smaller, localized trim feature).

(b) *For a bucket or contoured seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket or contoured seat.

S7.2 *Pelvis.*

S7.2.1 *H-point.* The H-points of each test dummy coincide within 1/2 inch in the vertical dimension and 1/2 inch in the horizontal dimension of a point 1/4 inch below the position of the H-point determined by using the equipment for the 50th percentile and procedures specified in SAE J826 (Apr 80), except that Table 1 of SAE J826 is not applicable. The length of the lower leg and thigh segments of the H-point machine are adjusted to 16.3 and 15.8 inches, respectively.

S7.2.2 *Pelvic angle.* As determined using the pelvic angle gauge (GM drawing 78051–532 incorporated by reference in Part 572, Subpart E of this Chapter) which is inserted into the H-point gauging hole of the dummy, the angle of the plane of the surface on the lumbar-pelvic adaptor on which the lumbar spine attaches is 23 to 25 degrees from the horizontal, sloping upward toward the front of the vehicle.

S7.3 *Legs.*

7.3.1 *For a test dummy in the driver position.* The upper legs of each test dummy rest against the seat cushion to the extent permitted by placement of the feet. The left knee of the dummy is positioned such that the distance from the outer surface of the knee pivot bolt to the dummy's midsagittal plane is six inches. To the extent practicable, the left leg of the test dummy is in a vertical longitudinal plane.

7.3.2 *For a test dummy in the outboard passenger positions.* The upper legs of each test dummy rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces is 11.5 inches. To the extent practicable, both legs of the test dummies in outboard passenger positions are in vertical longitudinal planes. Final adjustment to accommodate placement of feet in accordance with S7.4 for various passenger compartment configurations is permitted.

S7.4 *Feet.*

S7.4.1 *For a test dummy in the driver position.* The right foot of the test dummy rests on the undepressed accelerator with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel.

S7.4.2 *For a test dummy in the front outboard passenger position.* The feet of the test dummy are placed on the vehicle's toeboard with the heels resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed flat on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible so that the heels rest on the floorpan.

S7.4.3 *For a test dummy in either of the rear outboard passenger positions.* The feet of the test dummy are placed flat on the floorpan and beneath the front seat as far as possible without front seat interference. If necessary, the distance between the

knees can be changed in order to place the feet beneath the seat.

S8 *Phase-in of dynamic test and performance requirements.*

S8.1 *Passenger cars manufactured on or after September 1, 1993 and before September 1, 1994.*

S8.1.1 The number of passenger cars complying with the requirements of S3(c) shall be not less than 10 percent of:

(a) The average annual production of passenger cars manufactured on or after September 1, 1990, and before September 1, 1993, by each manufacturer, or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.1.

S8.2 *Passenger cars manufactured on or after September 1, 1994 and before September 1, 1995.*

S8.2.1 The number of passenger cars complying with the requirements of S3(c) shall be not less than 25 percent of:

(a) The average annual production of passenger cars manufactured on or after September 1, 1991, and before September 1, 1994, by each manufacturer, or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.2.

S8.3 *Passenger cars manufactured on or after September 1, 1995 and before September 1, 1996.*

S8.3.1 The number of passenger cars complying with the requirements of S3(c) shall be not less than 40 percent of:

(a) The average annual production of passenger cars manufactured on or after September 1, 1992, and before September 1, 1995, by each manufacturer, or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.3.

S8.4 *Passenger cars produced by more than one manufacturer.*

S8.4.1 For the purposes of calculating average annual production of passenger cars for each manufacturer and the number of passenger cars manufactured by each manufacturer under S8.1, S8.2, and S8.3, a passenger car produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S8.4.2:

(a) A passenger car which is imported shall be attributed to the importer.

(b) A passenger car manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

S8.4.2 A passenger car produced by more than one manufacturer shall be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 586, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S8.4.1.

Issued on: October 24, 1990

Jerry Ralph Curry
Administrator

55 F.R. 45722
October 30, 1990

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Impact Protection—Light Trucks, Buses, and Multipurpose Passenger Vehicles

(Docket No. 88-06; Notice 11)
RIN: 2127-AD43

ACTION: Final rule.

SUMMARY: This notice extends the quasi-static test requirements of Federal Motor Vehicle Safety Standard No. 214 to trucks, buses and multipurpose passenger vehicles with a GVWR of 10,000 pounds or less. These performance requirements, which currently apply only to passenger cars, mitigate occupant injuries in side impacts. Under this part of the standard, each side door is required to resist crush forces that are applied by a piston pressing a steel cylinder against the door's outside surface in a laboratory test. This rule is part of the NHTSA program to improve side impact protection for vehicle occupants.

EFFECTIVE DATE: The amendments made by this final rule to the *Code of Federal Regulations* are effective September 1, 1993.

SUPPLEMENTARY INFORMATION:

Background

NHTSA's standard for side impact protection is Federal Motor Vehicle Safety Standard No. 214. Since the standard became effective on January 1, 1973, it has specified performance requirements for each passenger car side door. The standard, through its provisions concerning side door strength, seeks to mitigate occupant injuries in side impacts by reducing the extent to which the side structure of a car is pushed into the passenger compartment during a side impact. The side door strength provisions of the standard require each door to resist crush forces that are applied by a piston pressing a steel cylinder against the door's outside surface in a laboratory test. The load is applied by means of a piston pressing a vertical steel cylinder against the middle of the door. The bottom of the cylinder is five inches above the lowest point of the door; the top of the cylinder extends above the bottom edge of the window opening by at least 0.5 inches. Car manufacturers have generally chosen to meet these performance requirements of the standard by reinforcing the side doors with metal beams

NHTSA's analysis of crash data has shown that the strengthening of passenger car side doors with the beams is effective, but primarily in single car side impacts. The agency's November 1982 study. "An Evaluation of Side Structure Improvements in Response to Federal Motor Vehicle Safety Standard No. 214," (DOT HS 806-314) estimated that 480 lives have been saved and 9,500 fewer hospitalizations have occurred per year as a result of the standard. The study also found that while single vehicle side impact occupant fatalities were reduced by 14 percent, the standard had little effect on reducing fatalities in multi-car side impact collisions.

During the past several years. NHTSA has been involved in a number of efforts to upgrade Standard No. 214, both in developing new dynamic procedures and requirements for passenger cars and in extending applicability of the long-established quasi-static passenger car requirements to trucks, buses and multipurpose passenger vehicles (MPV's) with a gross vehicle weight rating (GVWR) of 10,000 pounds or less (light trucks, vans and MPV's, or "LTV's").

For passenger cars, on October 30, 1990. NHTSA published in the *Federal Register* (55 FR 45722) a final rule adding dynamic test procedures and performance requirements to Standard No. 214. The final rule requires that a passenger car must provide protection in a full-scale crash test in which the car (known as the "target" car) is struck in the side by a moving deformable barrier simulating another vehicle. Instrumented test dummies are positioned in the target car to measure the potential for injuries to an occupant's thorax and pelvis. Also, on August 19, 1988, the agency published in the *Federal Register* 53 FR 31712) an advance notice of proposed rulemaking (ANPRM) concerning requirements for passenger cars intended to reduce the risk of head and neck injuries and ejections, in side impact crashes between vehicles and in other crashes where the protection provided by the side of the vehicle is a relevant factor. The ANPRM also sought comments on whether additional requirements should be considered to address side impacts with poles and trees.

NHTSA's efforts to extend side impact requirements to LTV's largely parallel its efforts with respect to passenger cars. On August 19, 1988, the agency published in the *Federal Register* (53 FR 31716) an ANPRM

regarding possible requirements for LTV's in each of the areas where requirements have been established, or are under consideration, for passenger cars. The ANPRM addressed: (1) extension to LTV's of Standard No. 214's existing static procedures and performance requirements, i.e., measuring crush strength performance in terms of the ability of each door to resist a piston pressing a rigid steel cylinder inward against the door, (2) developing dynamic test procedures and performance requirements for LTV's, similar to those proposed in the January 198B NPRM for passenger cars, and (3) developing requirements for LTV's intended to reduce the risk of head and neck injuries and ejections, similar to those addressed in the August 1988 ANPRM for passenger cars.

Of the various potential side impact requirements for LTV's that were addressed in the ANPRM, NHTSA is the most advanced with respect to the extension of Standard No. 214's existing side door strength requirements to these vehicles. The agency decided to go forward with rulemaking on that issue separately, since waiting until the agency is ready to address all of the potential requirements together would result in unnecessary delays and loss of safety benefits. Therefore, after considering comments on the ANPRM, NHTSA published a notice of proposed rulemaking (NPRM) in the *Federal Register* of December 22, 1989 (54 FR 52826) to extend the quasi-static test requirements for side door strength applicable for passenger cars to LTV's.

Summary of the Proposal

NHTSA proposed extending Standard No. 214's quasi-static test requirements to trucks, buses and MPV's with a GVWR of 10,000 pounds or less, effective September 1, 1992. NHTSA requested comment on whether a more limited extension would be appropriate, in light of the alleged potential impacts on final-stage manufacturers of multi-stage vehicles. In the proposal, NHTSA stated that it believed that manufacturers would comply with the requirements by adding metal beams to the side doors of these vehicles, similar to those currently added to passenger cars.

NHTSA recognized that a significant difference between passenger cars and many LTV's is that LTV's may have side doors that are not likely to have vehicle occupants sitting near them. Therefore, the agency proposed to exclude certain doors from the standard. The agency proposed to exclude: (1) any side door located so that no portion of an adjacent outboard designated seating position, with the seat adjusted to any position to which it can be adjusted, falls within the transverse, horizontal projection of the door's opening, and (2) any side door located adjacent to hardware for installation of an outboard seating position so that no portion of a seat recommended by the manufacturer for installation with that hardware, would when so installed, and adjusted as in (1), fall within the three dimensional area described in (1). (The term "outboard designated seating position" is defined in 49 CFR Part 571.3.)

NHTSA requested comments on a few issues relating to the proposed criteria for the exclusion of these doors. One issue was whether there should be an exclusion from the standard of rear side van doors if a small portion of the front of that side door is adjacent to the rear of the front seat. Another issue was whether rear van doors adjacent to aisleways should be excluded from coverage even though the seating positions on the other side of the aisleways might not be "outboard designated positions," because those aisle seats could be less than 12 inches from the side of the vehicle. NHTSA also requested comments on whether any other doors, such as detachable doors, should be excluded from the standard's coverage.

Brief Summary of Comments

NHTSA received comments from 21 parties. The majority of commenters supported extension of the side-door strength provisions of the standard to LTV's. Among those favoring the proposed extension were all insurance groups, consumer groups, and medical groups which commented. In addition, some motor vehicle manufacturers and associations of such manufacturers supported the proposal. Several manufacturers provided no position on the overall proposal, while commenting on specific aspects of the proposal. Others stated conditional support for the proposal with comments on specific aspects of it. One manufacturer did not support the proposal, while another suggested that action be delayed until action is taken on the potential dynamic side impact requirements for LTV's. A more detailed summary of comments and the NHTSA response to those comments is presented in later portions of this notice.

Summary of the Final Rule

After considering the comments and other available information, NHTSA has decided to extend the side door strength requirements of Standard No. 214 to LTV's. The final rule extends these requirements to LTV's with a GHVR of 10,000 pounds or less, except for walk-in vans. The requirements become applicable to the covered LTV's on September 1, 1993. The final rule establishes the same test procedure for LTV's as was proposed (i.e., the side door strength procedure that has applied to passenger cars since the standard became effective). As discussed more fully later in this notice, the rule excludes certain side doors from the side door strength requirements of the standard. Below, NHTSA discusses in greater detail the contents of the final rule and the reasons for its adoption.

Safety Need

As stated in the proposal, the number of LTV occupant fatalities increased during the 1980's, primar-

ily due to the greatly increasing sales of these vehicles and the use of these vehicles for passenger transportation. From 1985 to 1989, annual LTV fatalities increased from 6,738 to 8,578. LTV occupant non-fatal injuries have also been increasing. For example, between 1985 and 1989, the annual number of such injuries increased from 583,000 to 763,000. Sales of LTV's increased from approximately 4.5 million vehicles in 1985 to 4.9 million vehicles in 1988. With record-breaking sales years in 1985, 1986, 1987, and 1988, and projected sales of over 5.0 million vehicles per year into the future. NHTSA believes that these trends of increasing fatalities and injuries will continue.

Side impacts are a significant cause of LTV occupant fatalities, accounting for about 19 percent of all LTV occupant fatalities. Between 1985 and 1988, total LTV fatalities in side impacts increased from 1,247 to 1,625 annually, and estimated AIS 3-5 injuries increased from 4,890 to 5,940. LTV fatalities in single-vehicle side impact crashes increased from 546 to 717 annually between those years, and estimated AIS 3-5 injuries increased from 1,960 to 2,380. (The abbreviation "AIS" refers to Abbreviated Injury Scale, which is used to rank injuries by level of severity. An AIS 1 injury is a minor one, while an AIS 6 injury is one that is currently untreatable and fatal. AIS 3-5 injuries are those which are serious-to-critical.)

NHTSA recognized that, as significant as side impacts are in causing LTV occupant fatalities, side impacts are an even greater source of passenger car occupant fatalities, accounting for 32 percent of such fatalities. NHTSA stated in the proposal that the agency was concerned about the side impact problem for both passenger cars and LTV's and is addressing the problem in rulemaking for all of these vehicles. NHTSA further stated that even though the side impact problem may be greater for passenger cars than for LTV's, this does not negate the seriousness of the problem for LTV's or the desirability of taking action to address the problem.

NHTSA stated in the proposal that extension of the side door strength requirements to LTV's would likely result in significant safety benefits by reducing the extent to which the side structure of the LTV is pushed into the passenger compartment in a side-impact collision. NHTSA anticipated that manufacturers would comply with the proposed requirements by installing a longitudinal beam in each side door.

NHTSA received a number of comments concerning the safety need for the proposed requirement. Chrysler Corporation (Chrysler), while stating that it could meet the proposed requirements, asserted that compliance with them would do little except add weight and cost to a vehicle. Chrysler further asserted that LTV's perform better than passenger cars in side impact accidents, even without side door beams. Ford Motor Company (Ford) and the Motor Vehicle Manufacturers Association (MVMA) also asserted that LTV's without side door beams can offer at least equivalent side crush resistance as passenger cars with side door beams. The Insurance Institute for Highway Safety (IIHS) questioned whether door beams in LTV's have any significant effect in either vehicle-to-vehicle or vehicle-to-fixed-object impacts. However, IIHS agreed that the requirements would provide better door latch integrity by strengthening the door latch supporting structure. IIHS stated that this would reduce ejection during rollover. Nissan Research & Development, Inc. (Nissan) asserted that side door beams would be less effective in MPV's than in passenger cars. J. E. Tomassoni stated that a side door beam would be beneficial in side impact crashes.

After reviewing comments, NHTSA concludes that there is a safety need for extending the side door strength requirements to LTV's. NHTSA acknowledges that the problem of side impacts with fixed objects may be greater for passenger cars than for LTV's. However, this does not obviate the seriousness of the problem for LTV's or the desirability of taking action to address the problem. NHTSA concludes that changes made in LTV's (i.e., the installation of side door beams) in response to the requirements will reduce fatalities and injuries in single-vehicle crashes involving many fixed objects. The principal benefit of side door beams is their ability to transfer crash forces into the strong pillar structures of the vehicle. This force transfer results in reduced door intrusion since, with the beam, the door structure will no longer be required to absorb all the crash energy. This concept is applicable to both passenger car and LTV doors. Thus, NHTSA concludes that the installation of beams in LTV's will result in a substantial reduction in door intrusion, thereby reducing the risk of occupant injury. More specifically, NHTSA concludes that side door beams will be effective in LTV's in reducing fatalities in single vehicle side impacts with tall. unyielding, fixed objects (e.g., a pole or tree) as they are in passenger cars. This is because the crash behavior of passenger cars and LTV's is very similar in this type of impact. NHTSA concludes that side door beams will reduce fatalities and injuries in side impacts by minimizing side door intrusion into the occupant compartment of the vehicle and reducing the impact velocity of contact between a door and a vehicle occupant. In addition, NHTSA concludes that side door beams will significantly improve the integrity of door latches by strengthening the door latch supporting structure and thus reduce side door ejections.

Practicability

NHTSA stated in the proposal that it expected manufacturers to comply with the proposed side door strength requirements by reinforcing the side doors with metal beams, a practice manufacturers have

followed with passenger cars for a number of years. Ford commented that it has designed most of its LTV models without the space in the doors that would be needed for side impact door beams. Ford asserted that it would be costly and economically wasteful to package door beams as a running change to existing products. NHTSA has analyzed the information submitted by Ford. NHTSA concludes that it is possible for Ford and other manufacturers to meet the requirements by the September 1, 1993 effective date of the requirements of this final rule. NHTSA discusses the cost and leadtime issues raised by Ford in more detail in later portions of this notice.

Test Procedure

NHTSA proposed to specify the same test procedure for LTV's as that specified for passenger cars. Ford suggested that the test procedure be changed to represent better an actual side collision with a tall, narrow, fixed object. Specifically, Ford suggested that the bottom edge of the loading cylinder be extended downward to within 25-50 mm above the ground. Ford asserted that this approach would be less design restrictive than the existing test procedure since it would give vehicle manufacturers the choice of using door beams, strengthening the vehicle sill, or combining both design concepts. MVMA made the same suggestions as Ford. IIHS found merit in Ford's suggested test procedure. However, IIHS pointed out that the Ford procedure did not address the problem of the door opening during impact. IIHS asserted that this problem could be overcome by specifying that the door latch remain engaged and that both the door latch and the hinges remain attached to their mountings during the side door strength test. Range Rover of North America, Inc. (Range Rover) also asserted that the proposed test procedure is not representative of actual crash conditions. Range Rover suggested a "whole vehicle" intrusion test procedure that would have the test device extend above and below the highest and lowest parts of the vehicle in the vicinity of the test area.

NHTSA has evaluated the alternative test procedure suggested by Ford and MVMA (referred to hereafter as the "Ford procedure"). NHTSA believes that commenters have misconstrued the purpose of the side door strength test procedure. The purpose of test is to ensure that the door stiffness is sufficient to preclude excessive intrusion in the occupant compartment in moderately severe crashes, not to replicate certain actual side impacts. The Ford procedure would have a loading device engage both the door and the sill. Thus, the Ford procedure would assess the composite crush strength of the sill and the door combined. The Ford test method would not ensure adequate side door strength as long as the sill structure is the primary load path in the test. This could result in less occupant protection since side door strength is important in side impact collisions with fixed objects. In 1984 and 1985. NHTSA conducted four 45-degree-rigid-pole-side-impact tests. The test results show that the maximum compartment intrusion usually occurs at middle-door height, where a side door beam would provide protection.

In addition, NHTSA is not convinced that the Ford test procedure is representative of many side impact collisions with fixed objects. Vehicles are often rolling when they hit fixed objects. When vehicles are rolling, a fixed object may not engage the sill, as in the Ford test procedure, before excessive door intrusion occurs. NHTSA believes that during off-road sideways sliding, a vehicle's wheels often dig into the ground or are "tripped" on an object and the vehicle tilts in the direction of the slide. This results in the initial impact of the vehicle being close to the occupant's chest height, where a side door beam should provide protection. Rollover crashes are a frequent crash mode for LTV's, accounting for 46 percent of LTV occupant fatalities in 1988, compared to 24 percent for passenger cars. Since rollovers are a large component of the LTV safety problem, NHTSA believes that it is reasonable to conclude that many of the LTV rollovers involve the LTV in a rolled or tilted configuration as it strikes a fixed object in the door region.

Further, NHTSA is concerned that an LTV could "pass" the Ford test procedure even if it had very thin doors with practically no energy absorption capability. NHTSA recognizes that there is an option of proposing the Ford test procedure, but specifying higher force levels if the sill is engaged. However, NHTSA does not believe that this approach would measure a side door's resistance to crush any better than the current procedure. Further, the Ford approach would require much additional research and would delay this rulemaking. NHTSA does not believe that such delay is appropriate in view of the safety benefits that NHTSA expects to result from the adoption of this final rule.

Another disadvantage of the Ford test procedure is that it does not adequately address the integrity of the door latch system. A door latch could disengage or separate from its mounting during the test and still "pass" under the Ford procedure because the sill structure could provide needed strength to meet the requirements. NHTSA acknowledges that additional door latch integrity requirements could be added to the Ford procedure, as suggested by IIHS. However, this also would require much additional research and would delay this rulemaking. NHTSA does not believe that such delay is appropriate in view of the safety benefits that NHTSA expects to result from the adoption of this final rule.

The test procedure suggested by Range Rover would test the crush of the side door, the sill, and the roof and is similar to the procedure suggested by Ford.

NHTSA believes that its evaluation above of the Ford suggestion also applies to the Range Rover suggestion. As with the Ford procedure, the Range Rover test would not specifically address door intrusion, the principal benefit of the current test procedure for side door strength.

J. E. Tomassoni recommended that Standard No. 214 be modified to assure that the side structure will resist a significant force level to a distance of 18 inches. The standard currently allows the peak force to be reached at any distance up to 18 inches during the quasi-static test procedure. NHTSA is not amending the standard as recommended by Mr. Tomassoni. NHTSA believes that such an amendment would be beyond the scope of the proposed rule. In addition, NHTSA is not convinced that such a change in the standard is necessary. If the peak force is reached before 18 inches, this value will be sufficient to ensure the energy absorption level of the side door in this simulated crash environment is sufficient for providing occupant protection.

GM stated that careful study is needed to determine if a quasi-static crush test of side door strength and a dynamic crash test are both warranted for LTV's. NHTSA will undertake further research and will analyze the need for dynamic test requirements further before proposing any dynamic crash test for LTV's.

Ford asked whether double opening side cargo doors should be considered as two separate doors or treated as a system. This would affect where the longitudinal location of the loading cylinder is positioned for the side door strength test. NHTSA concludes that such doors should be treated as a system and tested simultaneously. NHTSA believes that the mid-point is the weakest region of double-opening doors. NHTSA believes that the test should determine the crush characteristics of the weakest region of the door, where the greatest intrusion is likely to occur. As discussed above, the purpose of the side door beam is to transmit loads to the pillar structures of the vehicle. These structures are at the ends of the door and generally have door hinges on one pillar and a door lock and latch on the other pillar. The door beam transmits crash forces through these hinges and the lock and latch mechanism into the pillars. Such a force-transmitting design will have its greatest deflection when the loads are applied at the mid-point. Such a test condition will ensure that, if a door has adequate strength and associated low intrusion at the mid-point, the strength will be at least as great at other locations. NHTSA intends to propose an amendment to section S.4 of Standard No. 214 in the near future to deal with the test procedure for double-opening doors. NHTSA also intends to propose an amendment to that section of the standard to clarify how a vehicle door without a window should be tested.

J. E. Tomassoni stated that section S3.2 of Standard No. 214 contains a typographical error (i.e., it refers to "the requirements of S3.2 1 through S3.2.2" rather than to "the requirements of S3.2.1 through S3.2.3). NHTSA agrees with Mr. Tomassoni and has corrected that error in this final rule.

Vehicle Population

NHTSA proposed to extend the side door strength requirements of Standard No. 214 to all LTV's with a GVWR of 10,000 pounds or less. In the proposal, NHTSA stated that the agency may consider extending the requirements on a more limited basis in the final rule.

NHTSA received a number of comments on the proposed vehicle population. General Motors Corporation (GM), Ford, and Chrysler suggested that the requirements be extended only to LTV's with a GVWR of 8,500 pounds or less and an unloaded vehicle weight (UVW) of 5,500 pounds or less. GM stated that in many of the vehicles with a GVWR between 8,500 and 10,000 pounds, occupants sit relatively high and would not benefit from a side door beam. Ford and Chrysler stated that their suggested weight limits would be consistent with those in Standard No. 208 for manual seat belts. The commenters also asserted that the lower weight limits would reduce the burden imposed on final-stage manufacturers and alterers. The National Truck Equipment Association (NTEA) opposed the extension of the side door strength requirements to commercial or vocational vehicles manufactured in two or more stages and outfitted with cargo carrying or work-related equipment. NTEA stated that if NHTSA decides to cover such multi-stage vehicles, limiting the extension of the requirements to vehicles with a GVWR of 8,500 pounds or less and an UVW of 5,500 pounds or less would be of significant assistance to the truck body and equipment industry since it would exclude many multi-stage vehicles. NTEA further stated that they would prefer limiting the extension of the requirements to vehicles with a GVWR of 6,000 pounds or less and a UVW of 5,000 pounds or less. NTEA asserted that the vehicles in this latter weight category are the ones most likely to be used for passenger transportation and for which passenger car safety standards would be most appropriate. The Recreation Vehicle Industry Association (RVIA) requested that NHTSA exclude motor homes, van conversions, and vans from the side door strength requirements. RVIA asserted that such vehicles are larger and much stronger structurally than passenger cars. If NHTSA decides not to exclude such vehicles. RVIA requested that the requirements only apply to vehicles with a GVWR of more than 6,000 pounds.

Grumman Olson requested that walk-in vans be excluded from the extension of the side door strength requirements. Grumman Olson asserted that the basic design of the walk-in van protects occupants during side impacts. According to Grumman Olson, there is

typically only one seating position in a walk-in van. The driver's shoulder is typically eight to 18 inches away from the side of the vehicle, thus providing crush space in the event of a side impact. Grumman Olson also stated that walk-in vans have sliding doors as side doors. Grumman Olson asserted that addition of a door beam to such a sliding door would not be sufficient for compliance with the side door strength test. The commenter further asserted that additional weight and/or structure would have to be added for compliance. According to Grumman Olson, such an increase in structure would decrease driver visibility and result in increased accidents at intersections. The commenter also stated that the increased weight would increase the effort required to operate the door and thus increase driver fatigue. The commenter further stated that the size of the lower guard would have to increase to meet the side door strength requirements. Grumman Olson contended that this would result in a tripping hazard since the door guide is at the outside edge of the step. Mercedes-Benz of North America, Inc. (Mercedes-Benz) suggested that NHTSA target the side door strength requirements of Standard No. 214 to those vehicles that would "truly benefit in single-vehicle accidents from the addition of side door beams."

After considering the comments and other information, the agency has decided to extend the side door strength requirements to LTV's with a GVWR of 10,000 pounds or less, except for walk-in vans. As discussed above, NHTSA has concluded that there is a safety need to extend the side door strength requirements of Standard No. 214 to LTV's. NHTSA has further concluded that the requirements would also serve a safety need in LTV's with a GVWR between 8,500 and 10,000 pounds. While commenters asserted that vehicle occupants typically sit higher in such vehicles, NHTSA has concluded that this does not lessen the safety need for side door strength requirements. In side impacts with poles and trees, the objects struck are typically taller than the LTV and its occupants. Research conducted by NHTSA indicates that the weight of a vehicle does not have a strong effect on the risk of injury to vehicle occupants in side crashes. Thus, LTV's between 8,500 pounds and 10,000 pounds GVWR do not offer greater crash protection in side impacts than LTV's less than 8,500 pounds GVWR. Further, the test procedure adopted by this final rule would specify a peak crush resistance of 12,000 pounds for all vehicles. Thus, there is no additional burden established for vehicles over 8,500 pounds GVWR. As discussed more fully in a later portion of this notice, NHTSA has also concluded that issues concerning the certification of compliance with the side door strength requirements of Standard No. 214 for multi-stage vehicles can be resolved for vehicles less than 10,000 pounds GVWR. Further, GM suggested an alternative of excluding walk-in vans from coverage if the GVWR cut-off was set at 10,000 pounds. NHTSA has adopted that alternative in this final rule.

NHTSA is excluding walk-in vans because the agency has concluded that it is impracticable for such vehicles to meet the side door strength requirements because of their special design features. As pointed out by Grumman Olson, a simple addition of a side door beam would not be sufficient to comply with the side door strength requirements. Rather, manufacturers would have to add additional weight and structure and completely change the side of the vehicle. NHTSA agrees with Grumman Olson that this increased weight and structure could have other safety implications.

NHTSA has decided to include motor homes, vans, and van conversions in the final rule. NHTSA does not agree with RVIA that there is a lesser safety need for covering such vehicles. That commenter stated that occupants of these vehicles are seated well above the most likely points of initial side impact in a vehicle that is larger, much stronger structurally, and provides more protection against side impacts than a passenger car. As discussed above, however, in side impacts with poles and trees, the objects struck are typically taller than the LTV and its occupants, and research conducted by the agency indicates that the weight of a vehicle does not have a strong effect on the risk of injury to vehicle occupants in side crashes. Thus, there are no indications of any lesser safety need for side impact protection in these vehicles. These vehicles are driven on the same roads and at the same times as other LTV's, and are thus subject to the same safety risks as other LTV's. NHTSA is not aware of any special characteristic of these vehicles that would reduce such risks. Moreover, neither RVIA nor any other commenter identified any characteristic in the design of these vehicles that would make it harder to meet the side door strength requirements than in other types of LTV's, nor is NHTSA aware of any such characteristic. Further, the cost of installing side door beams in these vehicles will not exceed the cost of installing them in other LTV's. After examining these factors, there is no apparent basis for excluding these vehicles from the side door strength requirements.

As mentioned above, NTEA suggested excluding certain vehicles produced in two or more stages from the side door strength requirements of Standard No. 214. NTEA asserted that NHTSA has not demonstrated that there is a safety need to extend the requirements to such vehicles. In the Final Regulatory Impact Analysis, NHTSA has analyzed the potential safety benefits of this final rule. However, NHTSA disagrees with the premise that the agency must quantify the magnitude of the safety problem and the safety benefits gained through adoption or extension of a safety standard for every conceivable subclass of a particular type of vehicle. NTEA apparently believes that NHTSA must demonstrate through analysis of crash data that there

is a safety need to protect occupants of every conceivable subclass of light truck (e.g., tow trucks, ambulances, bread delivery vehicles, public utility vehicles, snow plows, dump trucks, etc.). A similar argument was also made by RVIA. Crash data broken down by such discrete subclasses of LTV's are not available. Even if such detailed data were available, the data cells would likely be too small to draw statistically valid conclusions.

However, the National Traffic and Motor Vehicle Safety Act does not require this degree of specificity. Section 103(f)(3) of the Safety Act requires that a safety standard be "appropriate for the particular type of motor vehicle... for which it is prescribed." In 49 CFR 571.3, NHTSA has defined the types of motor vehicles and, for this rulemaking, the relevant vehicle types include trucks, multi-purpose passenger vehicles (MPV's), and buses with a GVWR of 10,000 pounds or less. NTEA's assertion that vehicles manufactured in more than one stage constitute a separate type of vehicle is not substantiated and runs counter to the Safety Act's legislative history. The Senate Report states that differences in safety standards "would be based on the type of vehicle rather than its place of origin or any special circumstances of its manufacture." S. Rep. No. 1301 (89th Cong., 2d Sess.) at 6.

In its comments, NTEA did not explain how its members' vehicles either offer improved side door strength or why the occupants of such vehicles do not require such protection. NTEA provided no data or even anecdotal information to support its position that the extension of the side door strength requirements of Standard No. 214 to vehicles manufactured by its members is not necessary. Since these vehicles are driven on the same roads and at the same times as other LTV's, they are subject to the same safety risks as other LTV's, absent some special vehicle characteristic that would reduce such risks. Indeed, the risk to occupants of many vehicles produced by NTEA members may even exceed that to occupants of other LTV's. For example, occupants of vehicles used for emergency or rescue purposes (e.g., ambulances and tow trucks) may be at greater risk than occupants of other LTV's.

NTEA has argued in other rulemakings involving extensions of safety standards to LTV's that because vehicles manufactured by its members are not intended to transport passengers and because they are driven by professionals, there is less safety need to apply safety standards to such vehicles. First, many LTV's manufactured by NTEA's members typically have passengers. Examples of such vehicles include ambulances (where an injured or ill person and a medical technician are typical passengers), tow trucks (where the disabled vehicle's driver is a typical passenger), and utility vehicles (which often have a two-person crew). Second, even if a light truck does not typically have passengers, NHTSA is still concerned about the risk to the driver. Indeed, 70 percent of all fatalities in light truck crashes are drivers. Finally, NTEA does not show that LTV's manufactured by its members are somehow safer because their drivers are "professionals." NTEA submitted no information about any special training or licensing requirements for operators of such LTV's and NHTSA is not aware of any such requirements.

Further, there is a legal issue concerning whether NHTSA is able to exclude vehicles produced in two or more stages from Standard No. 214 The court stated in *Chrysler Corp. v. Dept. of Transportation* that any differences between standards for different classes of vehicles are to "be based on type of vehicle rather than its place of origin or any special circumstances of its manufacturer." 472 F.2d 659, 679 (6th Cir. 1972). Thus, under this decision, NHTSA may not exclude vehicles from Standard No. 214 simply because they are manufactured in two or more stages. NHTSA acknowledges that a recent decision in *National Truck Equipment Association v. NHTSA,* 919 F.2d 1148 (6th Cir. 1990), seems to indicate that NHTSA does have authority to exclude commercial vehicles manufactured in two or more stages from coverage under a safety standard. However, even if authority can be found in the statute for such an approach, NHTSA does not believe that the approach would be appropriate here. NHTSA believes that the occupants of LTV's manufactured in two or more stages should be provided the same protection in side impacts as occupants of other LTV's. As discussed above, NHTSA does not believe that LTV's manufactured in two or more stages have any characteristics which provide better occupant protection in side impact collisions than other LTV's and NTEA did not offer any information to support such a conclusion. Later in this preamble, NHTSA discusses ways that final-stage manufacturers and alterers may comply with Standard No. 214.

Exclusion of Certain Side Doors

In the NPRM, NHTSA proposed to exclude certain side doors from coverage under the standard since the agency tentatively concluded that adding side beams to such doors would likely have little or no safety benefit. Specifically, NHTSA proposed to exclude: (1) any side door located so that no portion of an adjacent outboard designated seating position, with the seat adjusted to any position to which it can be adjusted, falls within the transverse, horizontal projection of the door's opening, and (2) any side door located adjacent to hardware for installation of an outboard seating position so that no portion of a seat recommended by the manufacturer for installation with that hardware, would when so installed, and adjusted as in (1), fall within the three dimensional area described in (1).

In the NPRM, NHTSA also requested comment on whether the agency should exclude rear side van doors where a small portion of the front of that side door is adjacent to the rear of the front seat. NHTSA further

requested comment on whether rear side doors adjacent to the aisleways in some vans should be excluded from coverage even if the seating positions on the other side of the aisleways might not be "outboard seating positions" as defined in 49 CFR 571.3 because those aisle seats could be less than 12 inches from the side of the vehicle. Finally, NHTSA requested comment on whether any other doors, such as detachable doors, should be excluded from coverage.

NHTSA received a number of comments on these issues. Motor Voters urged NHTSA to consider covering doors with no seating position nearby. According to Motor Voters, this would reduce the likelihood of ejection through those doors of unrestrained passengers seated in other positions or riding unseated in the rear of vans and minivans. The American Medical Association (AMA) opposed an exclusion for LTV doors that are not next to an outboard seat. AMA was concerned that any exclusion would encourage manufacturers to design LTV's to circumvent the side door strength requirements. RVIA supported the proposed exclusion of side doors that are not located adjacent to an outboard designated seating position. RVIA stated that this proposed exclusion would not adversely affect safety and would provide relief by reducing the number of doors that van converters (and motor home manufacturers if motor homes were covered in the final rule) would be required to test for compliance.

Chrysler supported the exclusions proposed by NHTSA in the NPRM. In addition, Chrysler supported an exclusion for doors in vans with seats on the aisle that are less than 12 inches from the side of the vehicle and, therefore, are outboard designated seating positions. Chrysler asserted that, because of the separation afforded by the aisleway, these doors will not have occupants sitting immediately adjacent to them and that adding side door beams would be of little benefit. Chrysler further supported an exclusion for side van doors where a small portion of the front of the door is adjacent to the rearmost part of a front outboard seating position. Chrysler suggested that the door be excluded unless the seat at its rearmost adjusted position extended into the projected door opening to the extent that the H-point was adjacent to the door or door opening. According to Chrysler, this suggested exclusion would apply even if a seat were not installed as original equipment, but could be installed at a later date using hardware available at that outboard seating position. Finally, Chrysler supported an exclusion for detachable doors. Chrysler pointed out that its Jeep Wrangler sport utility vehicle has lightweight, detachable doors. Chrysler asserted that the purchaser of a vehicle with light-weight, detachable doors would perceive that the doors do not meet side door crush performance requirements, just as the owner of a convertible is aware that the vehicle will not meet roof crush requirements. Nissan Research & Development, Inc. (Nissan) stated that an exclusion from the side door strength requirements is justified for doors where the only seat adjacent to the door is located an extended distance from the door (i.e., when a door is next to an aisle). Nissan asserted that there is a low possibility of injury from door intrusion to the seat's occupant in such a case. However, Nissan stated that studies of the relationship between the degree of door intrusion and injuries sustained were necessary to determine the appropriate distance between the inner surface of the door and the seat necessary to qualify for an exclusion. Nissan also stated that the criteria in NHTSA's proposed regulatory text concerning the exclusion for certain doors was unclear. Nissan recommended that the final rule exclude doors if, when adjacent outboard seats are adjusted anywhere within their forward-most or rearward-most range and with the seatbacks and seat lifters adjusted to the manufacturer's nominal design riding position, no portion of the torso of an SAE J826b test mannequin that is positioned in a seat is within the door opening projection.

NHTSA also received one comment supporting an extension of the strength requirements to structures that were not covered in the proposal. J. E. Tomassoni suggested that Standard No. 214 be modified to establish strength requirements for all side structures that are located adjacent to seats, not just doors.

After considering comments and other information, NHTSA has decided to exclude the following types of side doors from coverage under the final rule:

(1) any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H-point of a manikin placed in any seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4. falls within the transverse, horizontal projection of the door's opening,

(2) any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H-point of a manikin placed in any seat recommended by the manufacturer for installation in a location for which seat anchorage hardware is provided, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4. falls within the transverse, horizontal projection of the door's opening,

(3) any side door located so that a portion of a seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal protection of the door's opening, but a longitudinal vertical plane tangent to the outboard side of the seat cushion is more than 10 inches from the innermost point on the inside surface of the door at a height between the H-point and shoulder reference point (as shown in figure 1 of the Federal Motor Vehicle Safety Standard No. 210) and longitudinally between the front edge of the cushion with the

seat adjusted to its forwardmost position and the rear edge of the cushion with the seat adjusted to its rearmost position.

(4) any side door that is designed to be easily attached to or removed (e.g., using simple hand tools such as pliers and/or a screw driver) from a motor vehicle manufactured for operation without doors.

The first two exclusions are for doors that are unlikely to have vehicle occupants sitting near them. As discussed in the preamble to the NPRM. NHTSA believes that there is little safety benefit from having a side door beam for doors that are unlikely to have vehicle occupants sitting near them. While commenters asserted that covering doors with no seating positions nearby would reduce the likelihood of ejection through those doors of unrestrained passengers seated in other positions or riding unseated, NHTSA has concluded that the potential safety benefit would be insignificant and would not be justified in view of the cost of installing door beams in those doors. The principal benefit of side door beams is the reduction in passenger compartment intrusion. This reduces the risk of injury for occupants seated near the door. Little safety benefit would be gained by requiring side beams in door with no passengers seated near them.

After considering public comments, NHTSA has altered the scope of the first two exclusions to exclude a door from coverage even if a small portion of the front of that side door is adjacent to the rear of the front seat. NHTSA has concluded that, in a side impact with a fixed object, a door beam in the rear side door would provide little protection to a vehicle occupant sitting in the front seat. The occupant of such a seat is unlikely to be exposed to door intrusion in a such a side impact.

The third exclusion is for doors with an adjacent designated seating position more than ten inches from the inside surface of the vehicle. NHTSA has added this exclusion after considering public comments that doors should be excluded from coverage if the adjacent seats are on the other side of an aisleway of at least ten inches. NHTSA is excluding such side doors because NHTSA has concluded that vehicle occupants seated in such locations would benefit only minimally from the reduction in intrusion into the passenger compartment resulting from side door beams in a typical side impact with a fixed object. Based on available data, NHTSA has concluded that the intrusion into the occupant compartment is generally about four to six inches less than the exterior crush. Therefore, in a crash of moderate severity with an exterior crush of 12 to 16 inches, the intrusion into the occupant compartment would be about seven to 11 inches.

NHTSA is excluding side doors designed to be easily attached to or removed from motor vehicles manufactured for operation without doors because such doors have design features which make compliance with the side door strength requirements technologically and/or economically impracticable. As pointed out in the preamble to the NPRM, such doors may be made of plastic fabrics and metal wire frames and would not be able to meet the side door strength requirements. NHTSA has concluded that these doors cannot be redesigned to meet the requirements without completely changing the side of the vehicle.

Further, NHTSA does not believe that vehicle manufacturers will produce a new type of vehicle simply to avoid the side door strength requirements as suggested by one commenter. Although such doors have been excluded from coverage under Standard No. 206, *Door Locks and Door Retention Components,* NHTSA does not believe that manufacturers have produced vehicles with those doors simply to qualify for that exclusion.

NHTSA did not adopt the suggestion of J. E. Tomassoni to test all side structures adjacent to seats. First, NHTSA believes that such an amendment to the standard would be outside the scope of the proposed rule. Second, NHTSA does not have data to justify such a requirement for non-door structures. In fact, NHTSA believes that the non-door regions generally have higher crush strength characteristics than the door regions because of the surrounding supporting structure.

Safety Benefits of the Rule

As indicated above, in November 1982, NHTSA published an evaluation of the side door strength requirements for passenger cars. The report concluded that single vehicle side impact occupant fatalities were reduced by 14 percent. For side impacts with tall fixed objects and guard rails, the fatality reduction of side door beams was 23 percent. The report concluded that the standard did little to reduce fatalities in multi-car side impact collisions.

In the NPRM, NHTSA attributed the benefits of the side door strength requirements to the following facts: (1) the added side door beam helps to make a pole, tree, guardrail or other fixed object slide by the occupant's position, thus reducing intrusion into the passenger compartment, and (2) the strengthened striker/latch area of the door helps reduce ejections.

In the NPRM, NHTSA noted that two injury mechanisms are likely to occur in a typical side impact with a fixed object. First, the occupant strikes the door. This occurs before door intrusion reaches its maximum and added padding is beneficial to reducing the potential for injury then. Second, the intruding object (or the side structure of the vehicle when pushed inward by the fixed object) may strike the occupant. A side door beam reduces the possibility of this second injury mechanism from occurring.

NHTSA, in the NPRM and the Preliminary Regulatory Impact Analysis (PRIA), estimated that adding side door beams to LTV's would result in about 110 fewer fatalities and 950 fewer AIS 3-5 injuries each year. In calculating benefits, the NHTSA assumed in the NPRM and the PRIA that the effectiveness of side beams for LTV's involved in side-impact crashes would be the same as side beams for passenger cars. NHTSA made this assumption because: (1) many LTV's are exposed to the same traffic environment as cars, (2) side door beams are most effective in reducing occupant injuries in single-vehicle crashes, where the mass and height of a vehicle have little effect (unless the vehicle is involved in a rollover), and (3) the doors currently used on LTV's are similar to the doors used on passenger cars prior to the establishment of side door strength requirements for passenger cars. Since LTV's were not yet equipped with side door beams, NHTSA was unable to evaluate their effectiveness more thoroughly. Since light truck occupants generally sit higher than passenger car occupants, NHTSA presumed that they are less vulnerable in multi-vehicle collisions involving passenger cars. In side impacts with poles and trees, however, the objects struck are typically taller than either a passenger car or LTV. Therefore, the height differences between cars and LTV's would not affect the utility of side door beams in side impacts with poles and trees.

NHTSA also stated that installing side beams in LTV's could help reduce ejections in rollover or other non-side-impact crash modes. However, the agency did not attempt to quantify the potential benefits in those areas.

NHTSA received a number of comments concerning the projected benefits. As discussed above, a number of commenters asserted that side door beams would be less effective in LTV's than in passenger cars. Therefore, some commenters (e.g., Ford) asserted that NHTSA had overestimated potential safety benefits in the NPRM and PRIA. Ford asserted that the effectiveness of side door beams in single vehicle accidents was a function of accident type and that LTV's have a different distribution of accident types than passenger cars. Ford suggested a different methodology for estimating benefits based on this different distribution of accident types. In addition, some commenters further asserted that side door beams may have an adverse effect in vehicle-to-vehicle side impact collisions. Ford asserted that the "benefits" of side door beams may even be negative.

As discussed above, NHTSA has concluded that side door beams will reduce fatalities and injuries in side impacts by minimizing side door intrusion into the occupant compartment of the vehicle and reducing the impact velocity of contact between an intruding door and a vehicle occupant.

After considering the comments, NHTSA has analyzed further the estimates of benefits from the extension of the side door strength requirements to LTV's. NHTSA agrees with Ford that there is a difference in accident types between passenger cars and LTV's. NHTSA has estimated benefits for this final rule using a methodology similar to the one suggested by Ford for this aspect of the analysis.

NHTSA estimates that this final rule will avoid 59 to 83 fatalities and 914 to 1,223 non-fatal hospitalizations in single vehicle crashes. In multi-vehicle crashes. NHTSA estimates that this final rule will avoid 672 to 685 non-fatal hospitalizations. These estimates do not include potential benefits from possible reduced ejections in rollover or other non-side-impact crashes. NHTSA cannot quantify such potential benefits at this time. A more detailed analysis of benefits appears in the Final Regulatory Impact Analysis (FRIA).

NHTSA does not accept the assertion that side door beams have an adverse effect in vehicle-to-vehicle side impact collisions. Simulation studies have shown that the contact velocity of the occupant in a vehicle-to-vehicle side impact is reduced by a side door beam. Since contact velocity is related to injury potential, it is unlikely that side door beams could have an adverse effect in vehicle-to-vehicle side impact collisions.

Costs of the Rule

In the NPRM and the Preliminary Regulatory Impact Analysis (PRIA), NHTSA estimated that the cost of adding a side door beam to comply with the proposed side door strength requirements would average between \$16.15 and \$28.18 per LTV. Including the lifetime fuel costs of carrying the extra weight of the side door beams, NHTSA estimated that the cost per vehicle would average between \$36.93 and \$51.35. In the NPRM and the PRIA, NHTSA stated that another possible cost relates to secondary weight (i e., weight increases in other parts of the vehicle which might be made to compensate for the additional weight of side door beams). In the NPRM and the PRIA, NHTSA illustrated the potential impact of secondary weight by assuming that 0.7 pounds of secondary weight is added for each pound of primary weight (i.e., the weight of the side door beams). With these assumptions, NHTSA estimated that the total cost per vehicle would average between \$60.99 to \$78.13. NHTSA also estimated that the cost of conducting a compliance test for the side door strength requirements would be about \$1,600.

NHTSA received comments on the estimated costs of the proposed rule. RVIA asserted that each side door strength test performed by an independent test facility would cost \$6,290. According to RVIA, this figure does not include the cost of replacing or repairing doors destroyed or damaged by the test nor other costs for design, engineering, manufacturing, or administrative

support. As stated in the FRIA, compliance costs for the side door strength test for passengers cars were about $2,000 per test in 1988. NHTSA expects that the costs will be similar for LTV's. Thus, NHTSA believes that the costs generally should not be as high as asserted by RVIA. Further, even if the RVIA figure is correct, NHTSA believes that the testing costs will be negligible for almost all LTV's on a per vehicle basis.

Ford asserted that it would have difficulty meeting the requirements for one of its LTV models without making major design changes, which would be very costly. Ford estimated potential design and tooling costs in a confidential submission to NHTSA. However, since submission of its initial comment. Ford has developed and demonstrated to NHTSA a relatively simple way of meeting the side door requirements for the LTV model in question, without major design changes. Therefore, Ford's initial estimate of costs is no longer valid.

After considering the comments on the estimated costs of the proposed rule, NHTSA estimates that the cost of adding side door beams to comply with the final rule will average between $14.31 and $24.31 per covered LTV. NHTSA further estimates that the lifetime fuel costs of carrying the extra weight of the side door beams will average between $16.66 and $17.97. Thus, NHTSA estimates that the cost per vehicle will average between $30.97 and $42.28. NHTSA also performed a sensitivity analysis to illustrate the potential impact of secondary weight, assuming that 0.7 pounds of secondary weight is added for each pound of primary weight (i.e., the weight of the side door beams). With these assumptions, NHTSA estimated that the total cost per vehicle would average between $50.51 and $63.34. The above estimates all exclude the cost of adding side door beams to the rear side doors of vans since many of these doors are not covered by the requirements of this final rule. A more detailed analysis of the costs of the final rule appears in the FRIA.

Compliance by Multi-Stage Manufacturers

In the proposal, NHTSA addressed the issue of LTV's that are manufactured in more than one stage or altered after they are certified by the original manufacturer. There are a number of final-stage manufacturers, many of which are small businesses, involved in installing truck bodies and/or work-related equipment on chassis. There are also a number of alterers involved in modifying the structure of new vehicles. Under NHTSA's regulations, a final-stage manufacturer must certify that the completed vehicle conforms to all applicable safety standards and alterers must certify that the altered vehicle continues to comply with all applicable safety standards. Throughout the rest of this preamble, the term "final-stage manufacturer" is used to refer to both final-stage manufacturers and alterers.

In the proposal, NHTSA stated that the compliance test for side door strength is a destructive, whole system test, which could be difficult and/or expensive for many final-stage manufacturers to conduct, especially if they conducted such testing on many different types of vehicles. However, NHTSA stated that the vast majority of final-stage manufacturers would have available means to certify compliance that would not require testing. NHTSA's regulations require the manufacturers of truck or van chassis used by final-stage manufacturers to provide information on what limitations must be observed for the completed vehicle to comply with safety standards. The final-stage manufacturer can base its certification on the fact that it stayed within the limits set by the incomplete vehicle manufacturer. NHTSA stated in the proposal that, since the truck or van chassis purchased by final-stage manufacturers generally have side doors and the final-stage manufacturers generally do not change the side doors or structure supporting the side doors, certification with the proposed requirements could generally be based on staying within the incomplete vehicle manufacturer's limits. NHTSA also stated that if a final-stage manufacturer added a rear side door and did not wish to certify compliance for that door, it could avoid such certification by not installing a seat (or hardware for a seat) adjacent to the door.

NHTSA also stated in that proposal that some final-stage manufacturers, including some manufacturers of motor homes, build their own vehicle body structures, which include side doors. NHTSA further stated that these manufacturers are generally larger than most final-stage manufacturers and have greater engineering and testing expertise. The agency stated that it did not believe that the proposed requirements would be unduly burdensome to these manufacturers.

NHTSA tentatively concluded that the proposed requirements would not result in any significant burdens to final-stage manufacturers. However, the agency requested comments on the issue. NHTSA stated that, depending on the comments, the agency may consider options such as limiting application of the standard to vehicles with a GVWR or 8,500 pounds or less and an unloaded vehicle weight of 5,500 pounds or less, and/or excluding certain vehicles such as motor homes.

NHTSA received a number of comments on these issues. GM was concerned about coverage of "chopped" or "cut-away" chassis-cab incomplete vehicle models. GM stated that cut-away chassis-cab models are structurally very different from standard pickups or vans. According to GM, the open-rear design of these vehicles, which allows conversion into motor homes and various commercial trucks, lacks rear structure which may be needed to meet the side door strength requirements of the standard. RVIA was concerned about the impact of the proposed requirements on van converters.

The National Truck Equipment Association (NTEA) opposed the extension of the side door strength requirements to commercial or vocational trucks produced in two or more stages and which are designed to carry cargo or work-related equipment. NTEA acknowledged that extension of the side door strength requirements to LTV's should not pose a significant problem for many of the vehicles produced in the truck body and equipment industry. NTEA agreed with NHTSA that many final-stage manufacturers should be able to pass through the incomplete vehicle manufacturer's compliance certification for the requirements. NTEA further agreed with NHTSA that most, if not all, modifications performed by final-stage manufacturers should not affect compliance with the requirements. However, NTEA raised two possible areas of concern. First, for incomplete chassis-cabs, there will be no incomplete vehicle manufacturer's certification to pass-through. Second, since the requirements do not currently apply to LTV's, companies in the truck body and equipment industry do not know what limitations incomplete vehicle manufacturers will place on completed chassis-cabs to allow final-stage manufacturers to pass through the compliance certification for the side door strength requirements of Standard No. 214.

After considering these comments and other information, NHTSA has concluded that these requirements do not pose an unreasonable burden for final-stage manufacturers. NHTSA below outlines ways that final-stage manufacturers may certify compliance.

First, the final-stage manufacturer could stay within the limits set by the incomplete vehicle manufacturer. NHTSA's certification regulations require that the manufacturers of truck chassis used by final-stage manufacturers provide information regarding the limitations on the center of gravity, weight, and other attributes that must be observed in completing the vehicle so as not to affect the vehicle's compliance with the safety standards. Incomplete vehicle manufacturers which produce chassis-cabs must certify that their vehicles comply with applicable safety standards. Incomplete vehicle manufacturers which produce other vehicles that are not chassis-cabs (e.g., cutaway chassis or stripped chassis) are not required under NHTSA regulations to certify that their incomplete vehicles comply with safety standards. However, such manufacturers must provide subsequent stage manufacturers with an "incomplete vehicle document" that describes the limits within which the vehicle can be modified and still remain in compliance with safety standards. When the final-stage manufacturer observes the limits set by the incomplete vehicle manufacturer, it simply states that fact on the certification label. Under those circumstances, its certification of the vehicle's compliance with the safety standards is based on staying within the limits set by the incomplete vehicle manufacturer. Thus, if the final-stage manufacturer observes all of the limits specified by the incomplete vehicle manufacturer, the final-stage manufacturer does not have to conduct any testing or analysis to support its certification that the vehicle complies with the safety standards. NHTSA believes that final-stage manufacturers will be able to pass through the certification for a large percentage of multi-stage vehicles. NTEA agreed with this point in its comments. The side doors and structure supporting the side doors on multi-stage vehicles are generally not changed by final-stage manufacturers. New side doors are rarely fabricated for multi-stage vehicles, except walk-in vans and motor homes. As discussed above, walk-in vans are excluded from the side door strength requirements. Final-stage manufacturers which build their own vehicle body structures, including some manufacturers of motor homes, are generally larger than most final-stage manufacturers and have greater engineering and testing expertise. NHTSA believes that any manufacturer which has the resources and expertise to build its own vehicle body structures can easily add side door beams to the doors of its vehicles and conduct or sponsor any testing needed for certification. If a final-stage manufacturer added a rear side door and did not wish to certify compliance for the vehicle, it could avoid this by not installing a seat (or hardware for a seat) within ten inches of the door.

NHTSA believes that van converters will also be able to rely on prior certification of compliance with Standard No. 214. NHTSA believes that the front side doors of vans will be produced in compliance with the side door strength requirements because seats will be near the front side doors. NHTSA acknowledges that the rear side doors of some vans are not required to meet the side door strength requirements because the van has an aisle of ten or more inches between the seat and the door. In such a case, the van converter could rely on the prior certification if it limited installation of seats to areas at least ten inches from the door. In addition, van producers may respond to the market demand for vans with more possible seating positions and produce vehicles with rear side doors that meet the side door strength requirements.

NHTSA acknowledges that final-stage manufacturers of some vehicles (e.g., incomplete chassis cabs and cut-away chassis without structure for the side doors) may not be able to certify compliance with the standard by staying within the limits set by incomplete vehicle manufacturers. However, NHTSA does not believe that this will create significant difficulties. NHTSA believes that the final-stage manufacturer, with advice and direction from the incomplete vehicle manufacturer, can add sufficient structure to certify such a vehicle. Further, NHTSA does not believe that each final-stage manufacturer would have to conduct its own testing of such vehicles. If testing is necessary, final-stage manufacturers could sponsor testing by a company with testing expertise. In addition, it may not

be necessary to test each vehicle type. In appropriate situations, a final-stage manufacturer may be able to conduct or sponsor engineering analysis and/or computer simulations sufficient to enable it to certify, with due care, that a completed vehicle complied with applicable safety standards, including the side door strength requirements of Standard No. 214.

NHTSA also notes that NTEA did not assert that certification would be difficult or impossible for any of its members, only that there could be some difficulties. Without any data to support the request by NTEA for exclusions of vehicles produced by its members, NHTSA is reluctant to exclude those vehicles from the safety standard.

Leadtime

NHTSA stated in the proposal that manufacturers could comply with the proposed requirements by adding side door beams to the side doors of LTV's, similar to those used in passenger cars. Since manufacturers have considerable experience in meeting Standard No. 214's requirements for passenger cars, NHTSA proposed allowing a leadtime of two years for manufacturers to design, tool, and test the necessary modifications. Specifically, NHTSA proposed an effective date of September 1, 1992 for the proposed requirements.

The agency received a number of comments on the leadtime issue. Chrysler, Nissan, and Volkswagen of America, Inc. supported the proposed leadtime. GM suggested a phase-in starting September 1, 1993. Under the suggested phase-in, 25 percent of each manufacturer's vehicles would be required to meet the requirements the first year, 40 percent the year beginning September 1, 1994, and all vehicles would be required to meet the requirements by September 1, 1995. MVMA and Ford also supported a phase-in starting September 1, 1993. These commenters stated that a phase-in would allow manufacturers to make orderly engineering changes as part of their new product development program and to make the best use of resources. Ford asserted that earlier implementation of the rule without a phase-in provision would place undue hardship and cost on vehicle manufacturers. NTEA stated that, if NHTSA extended the side door strength requirements to LTV's which are produced in two or more stages, multi-stage manufacturers should be granted at least six months additional leadtime than that provided to manufacturers of incomplete vehicles. NTEA asserted that a final-stage manufacturer does not know what limitations may be placed on a chassis by an incomplete vehicle manufacturer for pass-through certification and what modifications may be necessary to meet the safety standard until the new chassis is introduced and the incomplete vehicle manufacturer's guidelines for completing the vehicle are published. NTEA pointed out that its members have no current experience in this area.

After considering these comments and other information, NHTSA has decided to make the new requirements effective on September 1, 1993. NHTSA has concluded that manufacturers need this time period to equip all LTV's with side door beams as standard equipment after the necessary design, tooling, and testing. In addition, final-stage manufacturers need this much time to decide how to certify compliance with the requirements. Therefore, for good cause shown, NHTSA finds that it is in the public interest to have an effective date later than one year after promulgation of this rule.

NHTSA does not believe that additional leadtime or a phase-in is necessary. Door beam technology has been used with passenger cars since 1973. Further, a few LTV's are currently manufactured with side door beams. While Ford initially asserted that the installation of side door beams in one of its models would require major design changes, Ford has since developed a beam design which can be installed in the door of the specific model without a major design change.

Chrysler and Mercedes suggested that NHTSA delay extension of the quasi-static test of side door strength until the dynamic side impact test for LTV's is developed. NHTSA has decided to adopt the quasi-static test of side door strength now, rather than wait for the dynamic test to be developed. NHTSA believes that the benefits of the side door beam, which NHTSA expects manufacturers to use to comply with the side-door strength requirements, will avoid many fatalities and serious injuries. Thus, NHTSA does not believe that it is appropriate to delay the implementation of the quasi-static performance requirement until the dynamic requirements are developed. In addition, NHTSA anticipates that the quasi-static and dynamic performance requirements for LTV's will be complementary as they are for passenger cars.

In consideration of the foregoing, 49 CFR Part 571 is amended as follows:

1. S2 is revised to read as follows:

S2. Applicability. This standard applies to passenger cars. Effective September 1, 1993, sections S3(a), S3(e), S3.1 through S3.2.3, and S4 of the standard apply to multipurpose passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less, except for walk-in vans.

2. A new section 2.1 is added as follows:

S2.1 Definitions.

"Walk-in van" means a van in which a person can enter the occupant compartment in an upright position.

3. S3 is revised to read as follows:

S3. Requirements. (a) Except as provided in section S3(e), each vehicle shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4.

(b) When tested under the conditions of S6. each passenger car manufactured on or after September 1, 1996 shall meet the requirements of S5.1. S5.2. and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(c) Except as provided in paragraph (d) of this section, from September 1, 1993 to August 31, 1996, a specified percentage of each manufacturer's yearly passenger car production, as set forth in S8, shall, when tested under the conditions of S6, meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(d) A manufacturer may, at its option, comply with the requirements of this paragraph instead of paragraph (c) of this section. When tested under the conditions of S6. each passenger car manufactured from September 1, 1994 to August 31, 1996 shall meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 571, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572. Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(e) A vehicle need not meet the requirements of sections S3.1 or S3.2 for—

(1) any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H-point of a manikin placed in any seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal projection of the door's opening,

(2) any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H-point of a manikin placed in any seat recommended by the manufacturer for installation in a location for which seat anchorage hardware is provided, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal projection of the door's opening,

(3) any side door located so that a portion of a seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal protection of the door's opening, but a longitudinal vertical plane tangent to the outboard side of the seat cushion is more than 10 inches from the innermost point on the inside surface of the door at a height between the H-point and shoulder reference point (as shown in Figure 1 of the Federal Motor Vehicle Safety Standard No 210) and longitudinally between the front edge of the cushion with the seat adjusted to its forwardmost position and the rear edge of the cushion with the seat adjusted to its rearmost position.

(4) any side door that is designed to be easily attached to or removed (e.g., using simple hand tools such as pliers and/or a screw driver) from a motor vehicle manufactured for operation without doors.

4. S3.2 is revised to read as follows:

S3.2 With seats installed in the vehicle. and located in any horizontal or vertical position to which they can be adjusted and at any seat back angle to which they can be adlusted, each vehicle must be able to meet the requirements of S3.2.1 through S3.2.3.

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Issued on June 10, 1991.

56 F.R. 27427
June 14, 1991

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Impact Protection

(Docket No. 88-06; Notice 13)
RIN: 2127-AE05

ACTION: Final rule, corrections.

SUMMARY: On October 30, 1990, NHTSA published in the *Federal Register* a final rule adding dynamic test procedures and performance requirements to Standard No. 214 (55 FR 45722). The dynamic test requirements of Standard No. 214 are phased in over a three-year period, beginning on September 1, 1993. At the same time, NHTSA also published final rules (1) establishing the specifications for the side impact dummy to be used in the dynamic crash test (55 FR 45757), (2) establishing the attributes of the moving deformable barrier (MDB) to be used in the dynamic crash test (55 FR 45770), and (3) establishing the reporting and recordkeeping requirements necessary for NHTSA to enforce the phase-in of the new dynamic test procedure (55 FR 45768). This rule corrects minor errors in the previous final rules and adds the Office of Management and Budget (OMB) approval number assigned under the Paperwork Reduction Act.

EFFECTIVE DATE: The amendments made by this rule to the text of the *Code of Federal Regulations* are effective September 17, 1991.

SUPPLEMENTARY INFORMATION:

Background

NHTSA's safety standard for side impact protection is Federal Motor Vehicle Safety Standard No. 214. On October 30, 1990. NHTSA published in *Federal Register* a final rule adding dynamic test procedures and the performance requirements to Standard No. 214 (55 FR 45722). The dynamic test requirements of Standard No. 214 are phased in over a three-year period, beginning on September 1, 1993. At the same time, NHTSA also published final rules (1) establishing the specifications for the side impact dummy to be used in the dynamic crash test (55 FR 45757), (2) establishing the attributes of the moving deformable barrier to be used in the dynamic crash test (55 FR 45770), and (3) establishing the reporting and recordkeeping requirements necessary for NHTSA to enforce the phasing-in of the new dynamic test procedure (55 FR 45768). (In this notice, NHTSA refers to the four final rules collectively as "the final side impact rules" or "the final rules.") NHTSA received four petitions for reconsideration of these final rules from (1) the Motor Vehicle Manufacturers Association (MVMA), (2) the Ford Motor Company (Ford), (3) the Association of International Automobile Manufacturers (AIAM), and (4) the International Standards Organization (ISO). NHTSA will respond to those petitions through a notice that will be published in the *Federal Register* later this year.

Summary of the Corrections

NHTSA has discovered a few mistakes in the final rules that require correction. NHTSA is making those corrections through this notice.

The corrections are not substantive. One changes the name of Standard No. 214 from *Side Door Strength* to *Side Impact Protection* to reflect the recently adopted dynamic test procedure. Another changes the numbering of the Figures in Standard No. 214 and makes minor corrections in the Figure for the MDB (now Figure 2). Another makes minor changes in the wording of 49 CFR §572.44(c) to improve clarity and make that section consistent with the drawings of the side impact test dummy (SID) that are incorporated by reference in the final rules. Another corrects a mistake to make clear that the records required by 49 CFR §586.6 must be maintained until December 31, 1998, as stated in preamble of the final reporting rule. The regulatory text included with the final reporting rule mistakenly stated that the records must be maintained until December 31, 1997. Another corrects the shoe size of the side impact dummy used in the compliance test for Standard No. 214. The final rule listed the shoe size as 11EE. The correct shoe size is 11EEE. Another correction provides further clarification by listing the track width of the MDB in the crabbed configuration.

The rule that established reporting and recordkeeping requirements necessary for NHTSA to enforce the phase-in contained information collection requirements, as that term is defined by OMB in 5 CFR Part 1320. NHTSA requested the approval of OMB for those information collection requirements under the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). OMB has approved the information collection requirements and assigned the Information Collection Requirement Number 2127-0558. NHTSA is amending the final rule

to show the Information Collection Requirement Number in the regulatory text.

As stated above, these amendments are effective upon publication of this notice. These amendments are merely technical corrections of the final rules that were published on October 30, 1990. They impose no new substantive requirements. Therefore, NHTSA finds for good cause that notice and opportunity for comment on these amendments are unnecessary. Because of the non-substantive nature of the amendments, NHTSA also finds for good cause that making the rule effective upon publication is in the public interest.

The following corrections are made in FR Documents 90-25391, 90-25392, 90-25393, and 90-25394, appearing on pages 45722 through 45780 in the issue of October 30, 1990:

1. On page 45752, first column, the heading is corrected to read as follows:

"**§571.214 Side impact protection**"

2. On page 45753, first column, the first sentence of S6.10 is corrected to read: "The moving deformable barrier conforms to the dimensions shown in Figure 2 and specified in part 587."

3. On page 45753, first and second columns, the first two sentences of S6.12 are corrected to read: "The test vehicle (vehicle A in Figure 3) is stationary. The line of forward motion of the moving deformable barrier (vehicle B in Figure 3) forms an angle of 63 degrees with the centerline of the test vehicle."

4. On page 45753, third column, the second sentence of S6.13.2 is corrected to read: "Each foot of the test dummy is equipped with a size 11EEE shoe, which meets the configuration size, sole, and heel thickness specifications of MIL-S-13192 (1976) and weighs 1.25 $\pm$0.2 pounds."

5. On page 45754, a corrected Figure 2 is substituted for the old Figure 1.

6. On page 45755, a corrected Figure 3 is substituted for the old Figure 2.

7. On page 45756. first column. the second sentence of S7.1.3(a) is corrected to read: "The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and, if possible, the same distance from the vehicle's longitudinal centerline as the midsagittal plane of a test dummy positioned in the driver position under S7.1.1."

§572.44 [AMENDED]

1. On page 45767, second column, the second sentence of §572.44(c) is corrected to read: "The accelerometer is mounted on the rear wall of the instrument cavity (Drawing SID-087), with its seismic mass center located from a point 0.9 inches upward and 0.5 inches to the left of the mounting bolt centerline and 0.4 to 0.5 inches rearward of the rear wall of the instrument cavity."

PART 586 [AMENDED]

The authority citation for Part 586 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1407, delegation of authority at 49 CFR 1.50.

§586.6 [AMENDED]

1. On page 45770, second column, §586.6 is corrected to read:

"Each manufacturer shall maintain records of the Vehicle Identification Number for each passenger car for which information is reported under §586.5(b)(2) until December 31, 1998.

(Approved by the Office of Management and Budget under control number 2127-0558)."

PART 587 [AMENDED]

1. The authority citation for Part 587 continues to read as follows:

Authority: 15 U.S.C. 1392. 1401. 1403. 1407; delegation of authority at 49 CFR 1.50.

§587.6 [AMENDED]

2. On page 45779, third column, §587.6(c) is corrected to read: "In configuration 2 (with two cameras and camera mounts, a light trap vane, and ballast reduced), the moving deformable barrier, including the impact surface, supporting structure, and carriage, weighs 3,015 pounds, has a track width of 74 inches in the crabbed configuration when the wheels are straight, and has a wheelbase of 102 inches."

Issued on September 11, 1991.

56 47007
September 17, 1991

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Impact Protection—Light Trucks, Buses, and Multipurpose Passenger Vehicles

(Docket No. 88–06; Notice 19)
RIN: 2127–AE32

ACTION: Final rule; response to petitions for reconsideration.

SUMMARY: On June 14, 1991, NHTSA published in the *Federal Register* (56 FR 27427) a final rule extending the quasistatic side door strength requirements of Federal Motor Vehicle Safety Standard No. 214, Side Impact Protection, to trucks, buses and multipurpose passenger vehicles with a gross vehicle weight rating of 10,000 pounds or less. The agency established an effective date of September 1, 1993 for the extension of these requirements. NHTSA received one petition for reconsideration of the final rule, from General Motors (GM). The petitioner requested that the agency phase-in the new requirements instead of applying them to all of the newly covered vehicles simultaneously. In response to GM's petition, NHTSA is establishing a brief phase-in period for the new requirements and is delaying by one year the effective date for double opening cargo doors, doors with no windows, and certain contoured doors. The agency notes, however, that it is adopting a different phase-in schedule from that suggested by the petitioner. NHTSA is also establishing the reporting and recordkeeping requirements necessary for it to enforce the phase-in. Finally, NHTSA is adopting a phase-in exclusion for vehicles manufactured in two or more stages and for altered vehicles.

DATES: The amendments in this final rule are effective September 1, 1993. NHTSA notes, however, that the amendments to Standard No. 214 have the effect of providing an additional year's leadtime for certain doors and vehicles.

SUPPLEMENTARY INFORMATION:

Background

On June 14, 1991, NHTSA published in the *Federal Register* (56 FR 27427) a final rule extending the quasistatic side door strength requirements of Federal Motor Vehicle Safety Standard No. 214, Side Impact Protection, to trucks, buses and multipurpose passenger vehicles (MPV's) with a gross vehicle weight rating of 10,000 pounds or less. (These vehicles are collectively referred to as "LTV's.") The agency established an effective date of September 1, 1993 for the extended applicability of the requirements, thus providing a leadtime of just over two years from the time of the final rule. Certain side doors, including ones that are more than a specified distance away from seats and therefore unlikely to have vehicle occupants sitting near them, were excluded from the coverage of the standard.

Standard No. 214's quasi-static requirements, which have applied to passenger cars since January 1, 1973, seek to mitigate occupant injuries in side impacts by reducing the extent to which the side structure of a vehicle is pushed into the passenger compartment during a side impact. The requirements specify that side doors must resist crush forces that are applied against the door's outside surface in a laboratory test. The load is applied by means of a piston pressing a vertical steel cylinder against the middle of the door. Since car manufacturers have generally chosen to meet the requirements by reinforcing the side doors with metal beams, the agency expects that LTV manufacturers will generally do the same.

Petition for Reconsideration

NHTSA received one petition for reconsideration of the final rule extending Standard No. 214's quasi-static side door strength requirements to LTV's, from General Motors (GM). The petitioner requested that, instead of making the requirements effective for all LTV's on September 1, 1993, the agency provide the following phase-in: 75 percent of LTV's manufactured in the production year beginning September 1, 1993, 90 percent of LTV's manufactured in the production year beginning September 1, 1994, and 100 percent of LTV's effective September 1, 1995.

GM stated that a phase-in of the requirements is essential for two reasons. First, that company noted that the agency has not yet established the test requirements for double cargo doors and for doors with no windows. GM stated that until the test requirements for double cargo doors and doors without windows are known, it cannot design the modifications needed to meet the requirements for those doors. According to the petitioner, the modifications may include structural or hardware changes as well as the installation of side door beams. GM stated that two years is an absolute minimum leadtime, barely allowing for validation of the design, and thus leaving inadequate time for other considerations such as cost and mass optimization.

GM also argued that because the requirements for some types of side doors are not yet completed, manufacturers cannot yet modify a vehicle to meet the requirements for all available types of side doors in one design iteration. According to GM, manufacturers generally implement design changes on all like models based on the most severe test requirements. Thus, if GM designed a particular model with sliding doors to meet Standard No. 214 and the test requirements for doors without windows or for double cargo doors later turned out to have the most severe implications on product design (e.g., required structural changes), GM's first redesign would be obsolete. The company indicated that a phase-in would help address this concern.

The second reason cited by GM in support of its argument that a phase-in is needed is the possible interaction between the requirements of Standard No. 214 and other safety standards, especially Standard No. 208, Occupant Crash Protection. GM argued that such interaction may require longer leadtime for some vehicles. (Under Standard No. 208, vehicles must meet specified injury criteria, including a head injury criterion (HIC), measured on test dummies in frontal barrier crash tests.)

According to GM, side door beams installed to meet Standard No. 214 can change a vehicle's frontal barrier performance enough to necessitate retesting to recertify the vehicles to Standard No. 208 and other standards. The company stated that the addition of door beams generally stiffens a vehicle's occupant compartment. While this usually helps reduce the likelihood of dummy head contacts in standard No. 208 testing, GM stated that its experience shows that stiffening the occupant compartment can also increase non-contact HICs in Standard No. 208 tests, particularly when using the Hybrid III test dummy (one of two alternative test dummies specified by the standard). In a meeting with NHTSA staff concerning its petition, GM provided data from crash tests for one model in which the addition of a roof reinforcement increased HIC from 930 to 1010, and the further addition of door beams raised HIC to 1250.

GM stated that the expected modifications for Standard No. 214 will substantially affect the performance in Standard No. 208 tests only in a minority of LTV models. The company argued, however, that some LTV models will likely need significant changes to achieve adequate performance in frontal barrier crashes because of crash pulse changes caused by the installation of side door beams and that it will not know which models need such changes until it completes the frontal barrier tests. GM argued that a phase-in is needed to provide the longer leadtime it believes is required to make the necessary design changes and conduct compliance testing for this group of LTV's.

The petitioner stated that the first year phase-in of 75 percent that it recommends would include all of a manufacturer's LTV's except perhaps one or two van models that have double cargo doors or doors without windows for which test requirements are not yet defined and/or one or two other LTV models that cannot be recertified to meet Standard No. 208 by September 1, 1993 if side door beams are added. GM stated that the second year phase-in of 90 percent that it recommends would include all of a manufacturer's LTV's except perhaps one small-vol-

ume LTV model that cannot yet be recertified to meet Standard No. 208 if side door beams are added.

GM also argued that its recommended phase-in would allow manufacturers to meet the new requirements with designs that are more optimized for cost and mass, and that are less likely to degrade other areas of vehicle performance. The company stated that manufacturers may use the phase-in to avoid diverting test and design resources from other important safety and crashworthiness projects, such as implementing air bags in advance of the mandated automatic restraint phase-in. Finally, GM stated that it believes that its proposed phase-in is reasonable and meets the intent of the agency to extend Standard No. 214's side door strength requirements to LTV's promptly and practicably.

While GM was the only petitioner for reconsideration, Chrysler submitted a letter strongly urging that NHTSA grant 's petition and adopt the phase-in schedule recommended by GM. Chrysler stated that it shared GM's concern that the test requirements for double-opening side cargo doors and doors without windows will not be available in time for it to meet the requirements by September 1, 1993. That company stated that while it does not manufacture any full-size vans/wagons with such doors which are sufficiently close to seats to be covered by the standard, it manufactures many such vans with those types of doors that are sold to van converters who do install seats close to the doors. Chrysler stated that it therefore expects to be asked to provide vehicles that meet door crush requirements to these final stage manufacturers so that they can take advantage of "pass-through" certification. Also, Ford Motor Company expressed its support for a brief phase-in, in a meeting with Department officials.

Summary of Amendments Being Made in Response to GM's Petition

In response to GM's petition, NHTSA is amending Standard No. 214 in several respects. First, the agency is establishing a brief phase-in for the newly-extended requirements. For the production year beginning September 1, 1993, 90 percent of a manufacturer's LTV's will be required to meet the new requirements; 100 percent compliance will be required effective September 1, 1994. Second, NHTSA is delaying by one year, to September 1, 1994, the effective date of the requirements for double opening cargo doors and doors with no windows, since the test procedure for these doors has not yet been established. The agency is also delaying the effective date for certain contoured doors, since it has determined that the test procedure for these doors also needs clarification.

Since NHTSA is adopting a phase-in, it is also establishing the reporting and recordkeeping requirements necessary for the agency to enforce the phase-in. Similar requirements have been adopted by the agency as an integral part of its phase-ins of other major new safety requirements. Finally, the agency is adopting a phase-in exclusion for vehicles manufactured in two or more stages and for altered vehicles.

Response to GM's Petition

Several commenters on NHTSA's proposal to extend Standard No. 214's side door strength requirements to LTV's requested a phase-in of the requirements. In the preamble to the June 1991 final rule, the agency addressed the related issues of leadtime and the appropriateness of a phase-in as follows:

> "After considering [the] comments and other information, NHTSA has decided to make the new requirements effective on September 1, 1993. NHTSA has concluded that manufacturers need this time period to equip all LTV's with side door beams as standard equipment after the necessary design, tooling, and testing. In addition, final-stage manufacturers need this much time to decide how to certify compliance with the requirements. * * *
>
> "NHTSA does not believe that additional leadtime or a phase-in is necessary. Door beam technology has been used with passenger cars since 1973. Further, a few LTV's are currently manufactured with side door beams. While Ford initially asserted that the installation of side door beams in one of its models would require major design changes, Ford has since developed a beam design which can be installed in the door of the specific model without a major design change." 56 FR 27436.

After considering GM's petition for reconsideration, however, NHTSA has concluded that GM's two primary arguments have merit and warrant changes in the standard's effective date. The agency's analysis of GM's arguments and a

discussion of the changes being made in response to those arguments follow.

NHTSA agrees with GM's first main argument that the lack of test procedures for double-opening cargo doors and doors without windows makes it impossible for manufacturers to complete the necessary design modifications for these doors. The agency indicated in the June 1991 final rule that it expected "in the near future" to propose amendments to address test procedures for these doors. However, the development of the proposal took longer than expected, and it was not published until January 15, 1992, with a comment closing date of March 16, 1992. See 57 FR 1716. Thus, the continuing lack of test procedures for these doors has cut much farther into the two-year leadtime period than expected. Assuming that a final rule is issued this summer or early Fall, the remaining leadtime would be little more than one year.

In order to ensure that the "practicability" requirements of the National Traffic and Motor Vehicle Safety Act are met and that manufacturers have sufficient leadtime for the necessary design, tooling, and testing of double-opening cargo doors and doors without windows, NHTSA has decided to extend the effective date for these doors by one year, to September 1, 1994. Assuming that the agency publishes a final rule concerning the test procedures some time this summer or early Fall, this will provide manufacturers with approximately two years leadtime for these doors.

NHTSA does not believe that GM's argument about its desire to modify all like models based on the most severe test requirements justifies relief beyond providing additional leadtime for the types of doors for which test procedures have not yet been established. First, even in the absence of the details of the test procedure, the agency believes that the performance requirements set forth in Standard No. 214 for double-opening cargo doors and doors without windows are sufficient for manufacturers to determine whether structural or other changes beyond adding a door beam will be required. Therefore, manufacturers should be able to determine whether these doors represent the most severe test requirement for a particular model and design other types of doors for the same model with that in mind, thereby avoiding a need for more than one design iteration. Second, given the safety benefits associated with this rulemaking, the agency believes that it would be inappropriate to delay application of the standard to types of doors for which design changes can easily be made merely to facilitate future compliance for other types of doors.

As discussed in the January 1992 notice of proposed rulemaking (NPRM) concerning test procedures for double-opening cargo doors and doors without windows, NHTSA has determined that clarification of the test procedure is also needed for certain contoured doors. The NPRM therefore proposed amendments to clarify the test procedure for contoured doors.

Standard No. 214's test procedure works well when a door's lower edge is essentially horizontal along its entire length, or only a small portion of the door's lower edge deviates from that description by being contoured upward. Almost all passenger cars have doors of these types. However, as discussed in the January 1992 NPRM, the standard's test procedure is not appropriate when only a small portion of a door's lower edge is horizontal and the edge is contoured significantly upwards for a large part of the door. Some LTV's have such doors. Since, in the absence of clarifying amendments concerning test procedures, these doors pose similar difficulties concerning compliance as those for double-opening cargo doors and doors without windows, NHTSA is also extending the effective date for these doors to September 1, 1994.

After reviewing the information submitted by GM in support of its petition, NHTSA is also persuaded that the possible interaction between the requirements of Standard No. 214 and other safety standards, particularly Standard No. 208, may require longer leadtime for a few vehicles.

As indicated above, NHTSA concluded in the June 1991 final rule that manufacturers required about two years leadtime for the design, tooling and testing necessary to meet the new requirements, and that additional leadtime was not needed in light of the time side door beam technology has been used for passenger cars. The two-year period did not, however, account for the possibility that a few vehicles, after being redesigned for Standard No. 214, might require further redesign to ensure that they continue to meet the dynamic test requirements of Standard No. 208.

NHTSA does not consider it likely, for a particular LTV, that the addition of side door

beams would increase HIC in Standard No. 208 testing. The occupant compartments of LTV's are generally stiffer than those of passenger cars, and any incremental stiffness that may result from the addition of side door beams is likely to be extremely small. Further, as indicated by GM, the stiffening of a vehicle's occupant compartment usually reduces the likelihood of dummy head contacts in frontal crash tests. For most current vehicles, this would be expected to reduce HIC. In addition, even if the addition of side door beams did slightly raise noncontact HIC, this would only affect the compliance of vehicles with Standard No. 208 if the vehicles previously only marginally complied with the standard. The agency believes that the small possibility of a particular vehicle's HIC being increased by the addition of side door beams is demonstrated by the fact that no other manufacturer has presented information to the agency concerning the problem. Further, GM, in responding to the agency's request for data concerning this problem, provided data for only one vehicle.

NHTSA agrees, however, that the test data presented by GM demonstrate that the addition of side door beams may, for a few vehicles, sufficiently affect HIC that further redesign will be necessary to ensure that the vehicles continue to meet Standard No. 208.

The agency has therefore decided to establish a brief phase-in for the new requirements. Accordingly, for the production year beginning September 1, 1993, 90 percent of a manufacturer's LTV's will be required to meet the new requirements; 100 percent compliance will be required effective September 1, 1994. Thus, the agency is providing an extra year's leadtime for up to 10 percent of a manufacturer's production of LTV's.

NHTSA believes that the phase-in being adopted will provide sufficient flexibility to cover the possibility that the compliance of a few LTV's with Standard No. 208 could be affected by the addition of side door beams and therefore need further redesign. The agency has carefully reviewed the information provided by GM and does not believe that the number of vehicles that could be affected would exceed 10 percent of that company's annual LTV production. Further, given the small number of vehicles, if any, that would be involved, the agency believes that an additional year's leadtime is ample for a manufacturer to make any additional changes necessary to ensure continuing compliance with Standard No. 208. Finally, given the fact that the delay in effective date affects no more than 10 percent of a manufacturer's LTV production for a single year and that it appears that not all manufacturers would avail themselves of the phase-in, any reduction in safety benefits is minimized.

NHTSA notes that it is not adopting the specific phase-in recommended by the petitioner, i.e., 75 percent of LTV's for the production year beginning September 1, 1993, and 90 percent of LTV's for the following year. The agency believes, for the reasons stated above, that the combination of delaying the effective date for double-opening cargo doors and doors without windows and the one-year phase-in adequately addresses the concerns raised by GM's two main arguments.

As indicated above, GM also asserted that its recommended phase-in would allow manufacturers to meet the new requirements with designs that are more optimized for cost and mass and that are less likely to degrade other areas of vehicle performance. That company also asserted that manufacturers may use the phase-in to avoid diverting test and design resources from other important safety and crashworthiness projects, such as implementing air bags in advance of the mandated automatic restraint phase-in. However, GM did not provide any evidence demonstrating that additional leadtime, beyond that provided by this final rule, is needed for design optimization or would result in any safety benefits by facilitating design improvements in other areas. In the absence of such evidence and given the reduced safety benefits that could result from a longer phase-in, the agency does not believe that a longer phase-in is appropriate.

In the NPRM proposing to extend the side door strength requirements of Standard No. 214 to LTV's, the agency requested that any commenters supporting a leadtime longer than two years address whether such longer leadtime is needed for all vehicles or whether the proposed amendments could be phased in for some vehicles at an earlier time. See 54 FR 52832, December 22, 1989. The agency thus addressed in the NPRM the possibility of a phase-in. Several commenters, including GM, Ford and the Motor Vehicle Manufacturers Association, supported a phase-in. Ford requested that the agency adopt in any final rule, provisions such as those in Standard No. 208

for production volumes, carryforward credits, and cars produced by more than one manufacturer.

While NHTSA did not discuss in the NPRM the specific requirements that would be associated with a phase-in, the agency has addressed that issue in three other rulemakings: (1) the establishment of Standard No. 208's automatic crash protection requirements for cars, (2) the extension of those requirements to LTV's, and (3) the establishment of Standard No. 214's dynamic side impact protection requirements for cars. In each case, for example, reporting and recordkeeping requirements have been integral parts of the phase-ins. Given that the agency raised the possibility of a phase-in in the NPRM and the general understanding commenters had concerning how the agency implemented phase-ins in other rulemakings, NHTSA believes that the establishment of specific phase-in requirements along the lines of those in Standard No. 208 and Standard No. 214 (dynamic side impact requirements for passenger cars) are within the scope of notice for this rulemaking.

As suggested by Ford in its comment on the NPRM, the agency is including provisions similar to those in Standard No. 208 for production volumes and vehicles produced by more than one manufacturer. As in the case of the agency's phase-in of Standard No. 214's dynamic requirements for passenger cars, NHTSA is not, however, including the provisions for carry-forward credits. The purpose of the limited phase-in adopted in response to GM's petition is to provide an additional year's leadtime for up to 10 percent of a manufacturer's LTV production. Carryforward credits are unnecessary to meet this purpose. Further, some LTV's already meet the requirements of Standard No. 214, and a provision permitting manufacturers to count such vehicles toward the 90 percent one-year requirement could unnecessarily dilute that requirement, resulting in reduced safety benefits.

NHTSA is also establishing the reporting and recordkeeping requirements necessary for the agency to enforce the phase-in. The requirements are similar to those adopted for Standards No. 208 and No. 214, although only a single report is required since the phase-in is for one year. For a further explanation of the agency's rationale for the specific requirements, see the preamble to the final rule establishing those requirements for the phase-in of Standard No. 214's dynamic requirements for passenger cars (56 FR 45768, October 30, 1990).

As the agency recognized for the phase-in of Standard No. 208's automatic restraint requirements for LTV's, a phase-in of requirements for LTV's has the possibility of creating significant problems for many final stage manufacturers and alterers. Like other manufacturers, final stage manufacturers and alterers must certify that their vehicles meet all applicable safety standards. Many of these manufacturers are small businesses and typically complete or modify vehicles based on instructions from the major manufacturers, as a basis for certification.

The potential problems that could be caused by applying a phase-in requirement to these manufacturers can be illustrated by considering the case of a van converter which purchases vans from GM, Ford or Chrysler and then alters them for the specialty market. If the one-year 90 percent phase-in requirement were applied to van converters, each van converter would need to ensure that 90 percent of the vans it altered complied with Standard No. 214. However, many van converters are very small and only alter a few vans each year. If the vehicles a particular van converter wanted to alter happened to be ones for which GM, Ford or Chrysler determined that the extra year's leadtime permitted by the phase-in was needed, it is highly unlikely the van converter could make the necessary design changes to those vehicles to certify that they would meet Standard No. 214.

In light of the potential problems that the phase-in could cause for final stage manufacturers and alterers, NHTSA is excluding LTV's manufactured in two or more stages and LTV's that are altered from Standard No. 214's requirements during the phase-in. This is the same approach that the agency followed for the phase-in of Standard No. 208's automatic crash protection requirements for LTV's. See 56 FR 12479–80, March 26, 1991. Because of this exclusion, this rule also permits original manufacturers the option to either include or exclude their LTV's that are sent to second stage manufacturers and alterers, when determining compliance during the phase-in for Standard No. 214.

This final rule does not have any retroactive effect. Under section 103(d) of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1392(d)), whenever a Federal motor vehicle safety

standard is in effect, a state may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard. Section 105 of the Act (15 U.S.C. 1394) sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

In consideration of the foregoing, Parts 571 and 586 of Title 49 of the Code of Federal Regulations are amended as follows:

Part 571—[AMENDED]

1. The authority citation for Part 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

2. In S571.214, S2.1, as added at 56 FR 27437, June 14, 1991, effective September 1, 1993, is revised to read as follows:

S2.1. Definitions.

Double cargo doors means a pair of hinged doors with the lock and latch mechanisms located where the door lips overlap.

Walk-in van means a van in which a person can enter the occupant compartment in an upright position.

3. In S571.214, S3, as revised at 56 FR 27437, June 14, 1991, effective September 1, 1993, is amended by revising S3(a) and adding new S3(e)(5) through S3(e)(7) to read as follows:

S3. Requirements. (a)(1) Except as provided in section S3(e), each passenger car shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4.

(2) Except as provided in section S3(e), each multipurpose passenger vehicle, truck and bus manufactured on or after September 1, 1994 shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4.

(3) Except as provided in section S3(e), from September 1, 1993 to August 31, 1994, at least 90 percent of each manufacturer's combined yearly production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less, as set forth in S9, shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4.

* * * * *

(e) * * *

(5) for multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any double cargo doors.

(6) for multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors without one or more windows.

(7) for multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors for which the ratio of the width of the lowest portion of the door to the width of the door at its widest point is not greater than 0.5. The width of the door is measured in a horizontal plane and on the outside surface of the door. The lowest portion of the door is that portion of the lower edge of the door which is lowest to the ground and which is essentially horizontal.

* * * * *

4. In S571.214, S9 through S9.2.3 are added to read as follows:

S9. Phase-in of side door strength requirements for multipurpose passenger vehicles, trucks and buses.

S9.1 Multipurpose passenger vehicles, trucks and buses manufactured on or after September 1, 1993 and before September 1, 1994.

S9.1.1 The combined number of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less complying with the requirements of S3(a)(3) shall not be less than 90 percent of:

(a) The average annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less manufactured on or after September 1, 1990 and before September 1, 1993 by each manufacturer, or

(b) The manufacturer's annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less during the period specified in S9.1.

S9.1.2 Walk-in vans, vehicles which do not have any side doors that can be used for occupant egress, vehicles which exclusively have doors of the types specified in S3(e), and vehicles specified in S9.2.3 may be excluded from all calculations of compliance with S9.1.1.

S9.2 Multipurpose passenger vehicles, trucks and buses produced by more than one manufacturer.

S9.2.1 For the purposes of calculating average annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less for each manufacturer and the number of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less manufactured by each manufacturer under S9.1.1, a vehicle produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S9.2.2:

(a) A vehicle which is imported shall be attributed to the importer.

(b) A vehicle manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

S9.2.2 A vehicle produced by more than one manufacturer shall be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 586, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S9.2.1.

S9.2.3 Each multipurpose passenger vehicle, truck and bus with a GVWR of 10,000 pounds or less that is manufactured in two or more stages or that is altered (within the meaning of S567.7 of this chapter) after having previously been certified in accordance with Part 567 of this chapter is not subject to the requirements of S3(a)(3).

Part 586 [AMENDED]

5. The authority citation for Part 586 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1407; delegation of authority at 49 CFR Part 1.50.

6. Section 586.1 is revised to read as follows:

S586.1 Scope.

This part establishes requirements for passenger car manufacturers to submit a report, and maintain records related to the report, concerning the number of passenger cars manufactured that meet the dynamic test procedures and performance requirements of Standard No. 214, Side Impact Protection (49 CFR 571.214), and it establishes requirements for manufacturers of multipurpose passenger vehicles, trucks and buses with a gross vehicle weight rating (GVWR) of 10,000 pounds or less to submit a report, and maintain records related to the report, concerning the number of such vehicles that meet the side door strength requirements of Standard No. 214.

7. Section 586.2 is revised to read as follows:

S586.2 Purpose.

The purpose of the reporting requirements is to aid the National Highway Traffic Safety Administration in determining whether a passenger car manufacturer has complied with the requirements of Standard No. 214, Side Impact Protection (49 CFR 571.214) concerning dynamic test procedures and performance requirements concerning side impact protection, and whether a manufacturer of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less has complied with the side door strength requirements of Standard No. 214.

8. Section 586.3 is revised to read as follows:

S586.3 Applicability.

This part applies to manufacturers of passenger cars and to manufacturers of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less. However, this part does not apply to any manufacturers of multipurpose passenger vehicles, trucks and buses whose production consists exclusively of walk-in vans, vehicles which do not have any side doors that can be used for occupant egress, vehicles which exclusively have doors of the types specified in S3(e) of 49 CFR 571.214, vehicles manufactured in two or more stages, and vehicles that are altered after previously having been certified in accordance with Part 567 of this chapter.

9. Section 586.4 is amended by revising paragraph (b) to read as follows:

S586.4 Definitions.

* * * * *

(b) Bus, gross vehicle weight rating or GVWR, multipurpose passenger vehicle, passenger car, and truck are used as defined in S571.3 of this chapter.

* * * * *

10. Section 586.5 is amended by revising the heading to read as follows:

S586.5 Reporting requirements—manufacturers of passenger cars.

* * * * *

11. Section 586.6 is amended by revising the heading to read as follows:

S586.6 Records—passenger cars.

* * * * *

12. Section 586.7 is redesignated as section 586.9 and revised to read as follows:

S586.9 Petition to extend period to file report. A petition for extension of the time to submit a report must be received not later than 15 days before expiration of the time stated in § 586.5(a) or § 586.7 (a). The petition must be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590. The filing of a petition does not automatically extend the time for filing a report. A petition will be granted only if the petitioner shows good cause for the extension and if the extension is consistent with the public interest.

13. Sections 586.7 and 586.8 are added to read as follows:

S586.7 Reporting requirements—manufacturers of trucks, buses and multipurpose passenger vehicles.

(a) *General reporting requirements.* Within 60 days after the end of the production year ending August 31, 1994, each manufacturer shall submit a report to the National Highway Traffic Safety Administration concerning its compliance with the requirements of S3(a) of Standard No. 214 for its trucks, buses and multipurpose passenger vehicles produced in that year. Each report shall—

(1) Identify the manufacturer;

(2) State the full name, title, and address of the official responsible for preparing the report;

(3) Contain a statement regarding whether or not the manufacturer complied with S3(a)(3) of Standard No. 214 and the basis for that statement;

(4) Provide the information specified in § 586.7(b);

(5) Be written in the English language; and

(6) Be submitted to: Administrator, National Highway Traffic Safety Administration, 400 Seventh Street, SW., Washington, DC 20590.

(b) *Report content*—(1) *Basis for phase-in production goals.* Each manufacturer shall provide the number of trucks, buses and multipurpose passenger vehicles with a GVWR of 10,000 pounds or less manufactured for sale in the United States for each of the three previous production years, or, at the manufacturer's option, for the current production year. A new manufacturer that has not previously manufactured trucks, buses and multipurpose passenger vehicles with a GVWR of 10,000 pounds or less for sale in the United States must report the number of such vehicles manufactured during the current production year.

(2) *Production.* Each manufacturer shall report the number of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less that meet the side door strength requirements (S3.1 or S3.2) of Standard No. 214.

(3) *Vehicles produced by more than one manufacturer.* Each manufacturer whose reporting of information is affected by one or more of the express written contracts permitted by 59.2.2 of Standard No. 214 shall:

(i) Report the existence of each contract, including the names of all parties to the contract, and explain how the contract affects the report being submitted.

(ii) Report the actual number of vehicles covered by each contract.

S586.8 Records—multipurpose passenger vehicles, trucks and buses.

Each manufacturer shall maintain records of the Vehicle Identification Number for each multipurpose passenger vehicle, truck and bus for which information is reported under § 586.7(b)(2) until December 31, 1996.

Issued on: July 7 1992.

Frederick H. Grubbe,
Deputy Administrator.
57 F.R. 30917
July 13, 1992

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 214
Side Impact Protection

(Docket No. 88–06, Notice 17)
RIN 2127–AE05

ACTION: Final rule; corrections.

SUMMARY: On September 17, 1991, NHTSA published in the *Federal Register* a final rule which corrected minor errors in the agency's October 1990 final rules concerning dynamic side impact requirements for passenger cars. The final rule also established an effective date for side impact phase-in reporting requirements. Today's final rule corrects two errors that were made in the September 17, 1991 final rule. First, Figure 2 of Standard No. 214, *Side Impact Protection,* which provides a schematic of the moving deformable barrier used in the dynamic side impact test, is corrected to include certain specifications that were inadvertently omitted. Second, the final rule establishes an effective date for certain of the side impact phase-in reporting requirements that were inadvertently not covered by the September 1991 final rule.

DATES: *Effective Date:* The amendments in this document and § 586.5, published at 55 FR 45770 on October 30, 1990, are effective June 22, 1992.

SUPPLEMENTARY INFORMATION: On October 30, 1990, NHTSA published in the *Federal Register* (55 FR 45722) a final rule adding dynamic test procedures and performance requirements to Standard No. 214, *Side Impact Protection.* The dynamic test requirements of Standard No. 214 are phased in over a three-year period, beginning on September 1, 1993. At the same time, NHTSA also published final rules: (1) establishing the specifications for the side impact dummy to be used in the dynamic crash test (55 FR 45757), (2) establishing the attributes of the moving deformable barrier (MDB) to be used in the dynamic crash test (55 FR 45770), and (3) establishing the reporting and recordkeeping requirements necessary for NHTSA to enforce the phase-in of the new dynamic requirements.

On September 17, 1991, NHTSA published in the *Federal Register* (56 FR 47007) a final rule which corrected minor errors in the October 1990 final rules. The final rule also amended the regulation establishing reporting and recordkeeping requirements, 49 CFR part 586, *Side Impact Phase-In Reporting Requirements,* to establish an effective date for the regulation's information collection requirements and to add the Office of Management and Budget (OMB) approval number assigned under the Paperwork Reduction Act.

Ford submitted a petition for reconsideration of the September 17, 1991 final rule, expressing concern that in revising the schematic of the MDB used in the dynamic side impact test (Figure 2 of Standard No. 214), NHTSA omitted specifications for face plate thickness, material strength, and aluminum alloy that were included in the earlier version of the schematic. That company stated that if the omission of the specifications was inadvertent, its letter should be considered a request for correcting the specifications promptly so that the existing ambiguity is eliminated.

In a letter dated December 17, 1991, NHTSA advised Ford that the omission of the specifications in the schematic of the MDB was inadvertent and that the agency planned to publish a correction notice. Today's final rule corrects Figure 2 of Standard No. 214 by adding the specifications that were inadvertently omitted in the September 17, 1991 final rule.

NHTSA is also setting an effective date for § 586 of part 586. That section was inadvertently not made effective in the September 1991 final rule. In addition, in order to make part 586 consistent with the rest of NHTSA's regulations, the agency is removing the OMB control number from § 586.6. It is NHTSA's standard practice to publish the OMB control numbers for all of its regulations in a single place, 49 CFR part 509,

OMB Control Numbers for Information Collection Requirements.

Today's amendments are effective 30 days after publication of this document in the *Federal Register*. The amendments are merely technical corrections of the final rule that was published on September 17, 1991, which itself made technical corrections of final rules published on October 30, 1990. Today's amendments do not impose any new substantive requirements. Therefore, NHTSA finds for good cause that notice and comment on these amendments are unnecessary. Because of the non-substantive nature of the amendments, NHTSA also finds for good cause that making the rule 30 days after publication is in the public interest.

In consideration of the foregoing, 49 CFR parts 571 and 586 are amended as follows:

Part 571—[Amended]

1. The authority section for part 571 continues to read as follows:

Figure 2 of § 571.214 is revised as follows:

Part 586—[Amended]

3. The authority section for part 586 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1407; delegation of authority at 49 CFR 1.50.

§ 586.6 [Amended]

4. Section 586.6 is amended by removing the parenthetical at the end of the section.

Issued on May 14, 1992.

Jerry Ralph Curry,
Administrator.

57 F.R. 21613
May 21, 1992

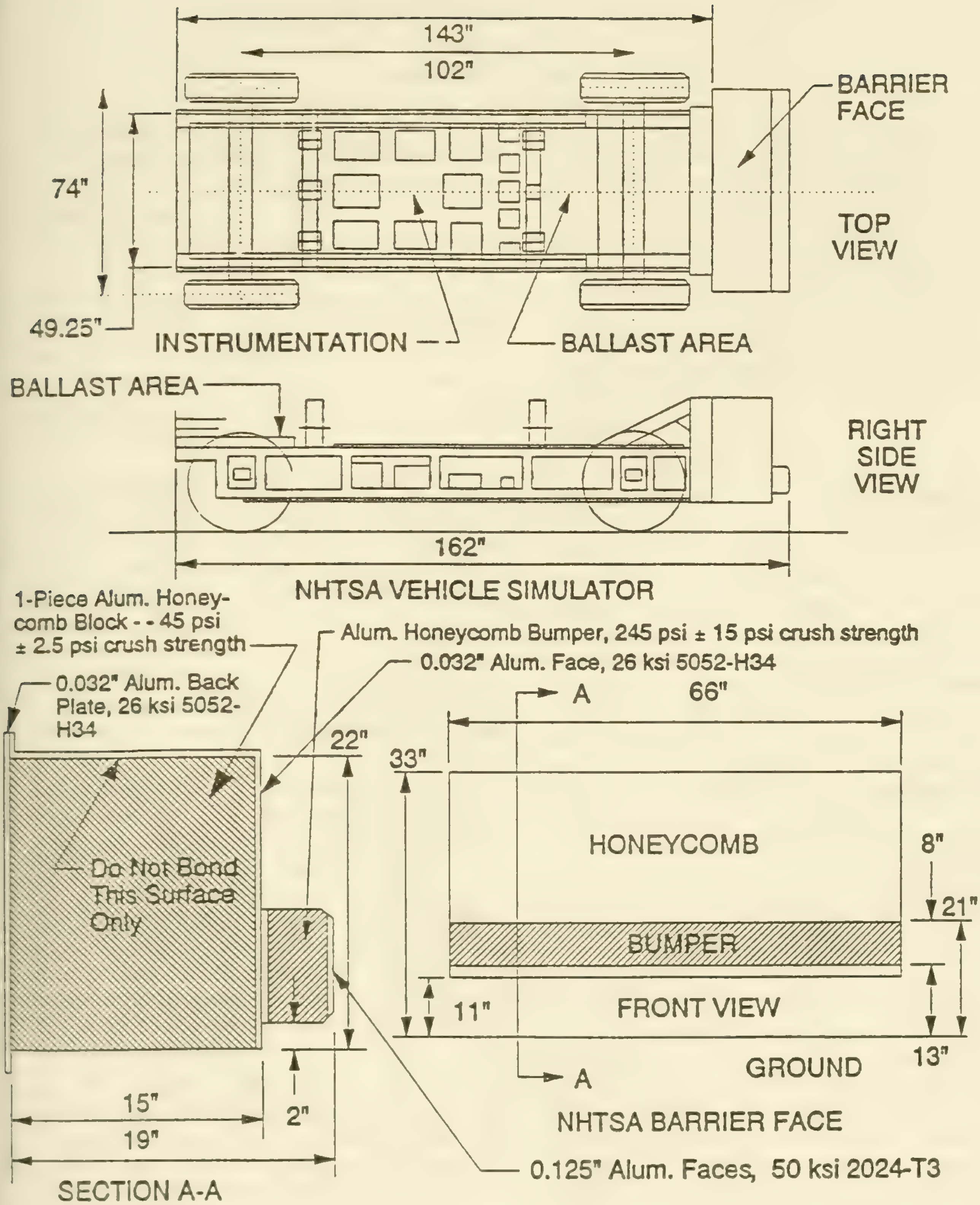


Figure 2—NHTSA Side Impactor—Moving Deformable Barrier

MOTOR VEHICLE SAFETY STANDARD NO. 214

Side Impact Protection
(Docket No. 2–6; Notice No. 3)

S1 Purpose and scope.

(a) *Scope.* This standard specifies performance requirements for protection of occupants in side impact crashes.

(b) *Purpose.* The purpose of this standard is to reduce the risk of serious and fatal injury to occupants of passenger cars in side impact crashes by specifying vehicle crashworthiness requirements in terms of accelerations measured on anthropomorphic dummies in test crashes, by specifying strength requirements for side doors, and by other means.

S2 Applicability. This standard applies to passenger cars. Effective September 1, 1993, sections S3(a), S3(e), S3.1 through S3.2.3, and S4 of the standard apply to multipurpose passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less, except for walk-in vans.

S2.1 Definitions.

Walk-in van means a van in which a person can enter the occupant compartment in an upright position.

[*Double cargo doors* means a pair of hinged doors with the lock and mechanisms located where the door lips overlap. **(57 F.R. 30917—July 13, 1992. Effective: September 1, 1993.)**]

S3 Requirements. (a)[(1)] Except as provided in section S3(e), each [passenger car] shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress are tested according to S4.

[(2) Except as provided in section S3(e), each multipurpose passenger vehicle, truck and bus manufactured on or after September 1, 1994, shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4.

[(3) Except as provided in section S3(e), from September 1, 1993 to August 31, 1994, at least 90 percent of each manufacturer's combined yearly production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less, as set forth in S9, shall be able to meet the requirements of either, at the manufacturer's option, S3.1 or S3.2, when any of its side doors that can be used for occupant egress is tested according to S4. **(57 F.R. 30917—July 13, 1992. Effective: September 1, 1993.)**]

(b) When tested under the conditions of S6, each passenger car manufactured on or after September 1, 1996, shall meet the requirements of S5.1 S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(c) Except as provided in paragraph (d) of this section, from September 1, 1993 to August 31, 1996, a specified percentage of each manufacturer's yearly passenger car production, as set forth in S8, shall, when tested under the conditions of S6, meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(d) A manufacturer may, at its option, comply with the requirements of this paragraph instead of paragraph (c) of this section. When tested under the conditions of S6, each passenger car manufactured from September 1, 1994 to August 31, 1996, shall meet the requirements of S5.1, S5.2, and S5.3 in a 33.5 miles per hour impact in which the car is struck on either side by a moving deformable barrier. Part 572, Subpart F test dummies are placed in the front and rear outboard seating positions on the struck side of the car. However, the rear seat requirements do not apply to passenger cars with a wheelbase greater than 130 inches, or to passenger cars which have rear seating areas that are so small that the Part 572, Subpart F dummies cannot be accommodated according to the positioning procedure specified in S7.

(e) A vehicle need not meet the requirements of sections S3.1 or S3.2 for—

(1) any side door located so that no point on a ten-inch horizontal longitudial line passing through and bisected by the H-point of a manikin placed in any seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal projection of the door's opening;

(2) any side door located so that no point on a ten-inch horizontal longitudinal line passing through and bisected by the H-point of a manikin placed in any seat recommended by the manufacturer for installation in a location for which seat anchorage hardware is provided, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal projection of the door's opening;

(3) any side door located so that a portion of a seat, with the seat adjusted to any position and the seat back adjusted as specified in section S6.4, falls within the transverse, horizontal protection of the door's opening, but a longitudinal vertical plane tangent to the outboard side of the seat cushion is more than 10 inches from the innermost point on the inside surface of the door at a height between the H-point and shoulder reference point (as shown in Figure 1 of Federal Motor Vehicle Safety Standard No. 210) and longitudinally between the front edge of the cushion with the seat adjusted to its forwardmost position and the rear edge of the cushion with the seat adjusted to its rearmost position; or

(4) any side door that is designed to be easily attached to or removed (e.g., using simple hand tools such as pliers and/or a screw driver) from a motor vehicle manufactured for operation without doors.

[(5) For multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any double cargo doors.

(6) For multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors without one or more windows.

(7) For multipurpose passenger vehicles, trucks, and buses manufactured before September 1, 1994, any doors for which the ratio of the width of the lowest portion of the door to the width of the door at its widest point is not greater than 0.5. The width of the door is measured in a horizontal plane and on the outside surface of the door. The lowest portion of the door is that portion of the lower edge of the door which is lowest to the ground and which is essentially horizontal. **(57 F.R. 30917—July 13, 1992. Effective: September 1, 1993.)]**

S3.1 With any seats that may affect load upon or deflection of the side of the vehicle removed from the vehicle, each vehicle must be able to meet the requirements of S3.1.1 through S3.1.3.

S3.1.1 Initial Crush Resistance. The initial crush resistance shall be not less than 2,250 pounds.

S3.1.2 Intermediate Crush Resistance. The intermediate crush resistance shall not be less than 3,500 pounds.

S3.1.3 Peak crush resistance. The peak crush resistance shall not be less than two times the curb weight of the vehicle or 7,000 pounds, whichever is less.

S3.2 With seats installed in the vehicle, and located in any horizontal or vertical position to which they can be adjusted and at any seat back angle to which they can be adjusted, each vehicle must be able to meet the requirements of S3.2.1 through S3.2.3.

S3.2.1 Initial crush resistance. The initial crush resistance shall not be less than 2,250 pounds.

S3.2.2 Intermediate crush resistance. The intermediate crush resistance shall not be less than 4,375 pounds.

S3.2.3 Peak crush resistance. The peak crush resistance shall not be less than three and one half times the curb weight of the vehicle or 12,000 pounds, whichever is less.

S4 Test procedures. The following procedures apply to determining compliance with section S3:

(a) Place side windows in their uppermost position and all doors in locked position. Place the sill of the side of the vehicle opposite to the side being tested against a rigid unyielding vertical surface. Fix the vehicle rigidly in position by means of tiedown attachments located at or forward of the front wheel centerline and at or rearward of the rear wheel centerline.

(b) Prepare a loading device consisting of a rigid steel cylinder or semi-cylinder 12 inches in diameter with an edge radius of one-half inch. The length of the loading device shall be such that the top surface of the loading device is at least one-half inch above the bottom edge of the door window opening but not of a length that will cause contact with any structure above the bottom edge of the door window opening during the test.

(c) Locate the loading device as shown in Figure 1 (side view) of this section so that—

(1) Its longitudinal axis is vertical;

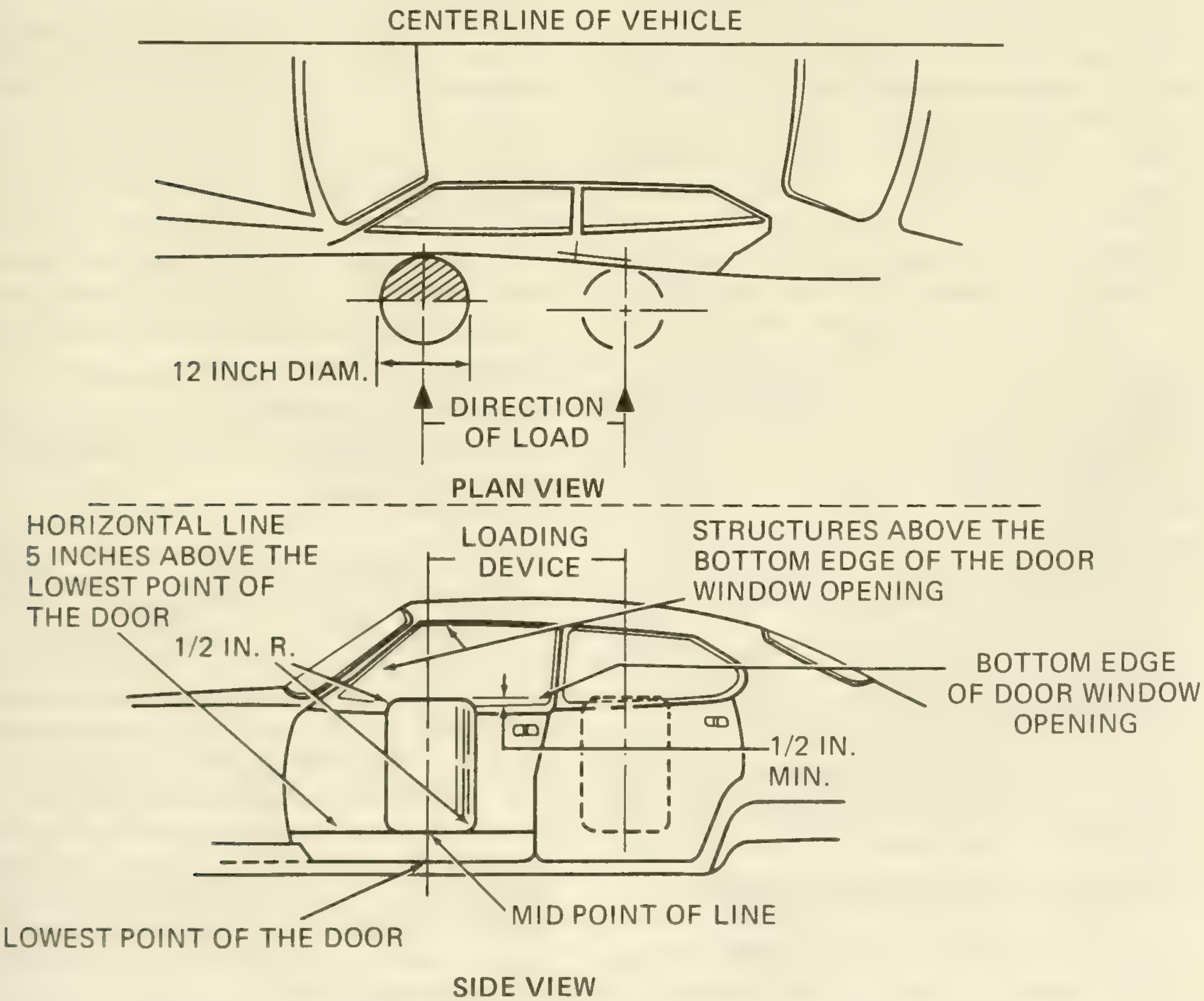


Figure 1—Loading Device Location and Application to the Door

(2) Its longitudinal axis is laterally opposite the midpoint of a horizontal line drawn across the outer surface of the door 5 inches above the lowest point of the door;

(3) Its bottom surface is in the same horizontal plane as the horizontal line described in subdivision (2) of this subparagraph; and

(4) The cylindrical face of the device is in contact with the outer surface of the door.

(d) Using the loading device, apply a load to the outer surface of the door in an inboard direction normal to a vertical plane along the vehicle's longitudinal centerline. Apply the load continuously such that the loading device travel rate does not exceed one-half inch per second until the loading device travels 18 inches. Guide the loading device to prevent it from being rotated or displaced from its direction of travel. The test must be completed within 120 seconds.

(e) Record applied load versus displacement of the loading device, either continuously or in increments of not more than 1 inch or 200 pounds for the entire crush distance of 18 inches.

(f) Determine the initial crush resistance, intermediate crush resistance, and peak crush resistance as follows—

(1) From the results recorded in subparagraph (e) of this paragraph, plot a curve of load versus displacement and obtain the integral of the applied load with respect to the crush distances specified in subdivisions (2) and (3) of this paragraph. These quantities, expressed in inchpounds and divided by the specified crush distances, represent the average forces in pounds required to deflect the door those distances.

(2) The initial crush resistance is the average force required to deform the door over the initial 6 inches of crush.

(3) The intermediate crush resistance is the average force required to deform the door over the initial 12 inches of crush.

(4) The peak crush resistance is the largest force recorded over the entire 18-inch crush distance.

S5 Dynamic performance requirements.

S5.1 Thorax. The Thoracic Trauma Index (TTI(d)) shall not exceed 85 g for passenger cars with four side doors, and shall not exceed 90 g for passenger cars with two side doors, when calculated in accordance with the following formula—

$$TTI(d)=\frac{1}{2}(G_R+G_{LS})$$

The term "G_R" is the greater of the peak accelerations of either the upper or lower rib, expressed in g's and the term "G_{LS}" is the lower spine (T12) peak acceleration, expressed in g's. The peak acceleration values are obtained in accordance with the procedure specified in S56.13.5.

S5.2 Pelvis. The peak lateral acceleration of the pelvis, as measured in accordance with S6.13.5, shall not exceed 130 g's.

S5.3 Door opening.

S5.3.1 Any side door, which is struck by the moving deformable barrier, shall not separate totally from the car.

S5.3.2 Any door (including a rear hatchback or tailgate), which is not struck by the moving deformable barrier, shall meet the following requirements—

S5.3.2.1 The door shall not disengage from the latched position;

S5.3.2.2 The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle; and

S5.3.2.3 Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

S6 Test conditions.

S6.1 Test weight. Each passenger car is loaded to its unloaded vehicle weight, plus its rated cargo and luggage capacity, secured in the luggage area, plus the weight of the necessary anthropomorphic test dummies. Any added test equipment is located away from impact areas in secure places in the vehicle. The car's fuel system is filled in accordance with the following procedure: With the test vehicle on a level surface, pump the fuel from the vehicle's fuel tank and then operate the engine until it stops. Then, add Stoddard solvent to the test vehicle's fuel tank in an amount which is equal to not less than 92 percent and not more than 94 percent of the fuel tank's usable capacity stated by the vehicle's manufacturer. In addition, add the amount of Stoddard solvent needed to fill

the entire fuel system from the fuel tank through the engine's induction system.

S6.2 Vehicle test attitude. Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition. The "as delivered" condition is the vehicle as received at the test site, filled to 100 percent of all fluid capacities and with all tires inflated to the manufacturer's specifications listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's "fully loaded condition." The "fully loaded condition" is the test vehicle loaded in accordance with S6.1. The load placed in the cargo area is centered over the longitudinal centerline of the vehicle. The pretest vehicle attitude is equal to either the as delivered or fully loaded attitude or between the as delivered attitude and the fully loaded attitude.

S6.3 Adjustable seats. Adjustable seats are placed in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

S6.4 Adjustable seat back placement. Place adjustable seat backs in the manufacturer's nominal design riding position in the manner specified by the manufacturer. If the position is not specified, set the seat back at the first detent rearward of 250 from the vertical. Place each adjustable head restraint in its highest adjustment position. Position adjustable lumbar supports so that they are set in their released, i.e. full back, position.

S6.5 Adjustable steering wheels. Adjustable steering controls are adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions.

S6.6 Windows. Movable vehicle windows and vents are placed in the fully closed position on the struckside of the vehicle.

S6.7 Convertible tops. Convertibles and openbody type vehicles have the top, if any, in place in the closed passenger compartment configuration.

S6.8 Doors. Doors, including any rear hatchback or tailgate, are fully closed and latched but not locked.

S6.9 Transmission and brake engagement. For a vehicle equipped with a manual transmission, the transmission is placed in second gear. For a vehicle equipped with an automatic transmission, the transmission is placed in neutral. For all vehicles, the parking brake is engaged.

S6.10 Moving deformabie barrier. The moving deformable barrier conforms to the dimensions shown in Figure 2 and specified in Part 587.

S6.11 Impact reference line. For vehicles with a wheelbase of 114 inches or less, on the side of the vehicle that will be struck by the moving deformable barrier, place a vertical reference line which is 37 inches forward of the center of the vehicle's wheelbase. For vehicles with a wheelbase greater than 114 inches, on the side of the vehicle that will be struck by the moving deformable barrier, place a vertical reference line which is 20 inches rearward of the centerline of the vehicle's front axle.

S6.12 Impact configuration. The test vehicle (vehicle A in Figure 3) is stationary. The line of forward motion of the moving deformable barrier (vehicle B in Figure 3) forms an angle of 63 degrees with the centerline of the test vehicle. The longitudinal centerline of the moving deformable barrier is perpendicular to the longitudinal centerline of the test vehicle when the barrier strikes the test vehicle. In a test in which the test vehicle is to be struck on its left (right) side: all wheels of the moving deformable barrier are positioned at an angle of 27 ± 1 degrees to the right (left) of the centerline of the moving deformable barrier; and the left (right) forward edge of the moving deformable barrier is aligned so that a longitudinal plane tangent to that side passes through the impact reference line within a tolerance of ±2 inches when the barrier strikes the test vehicle.

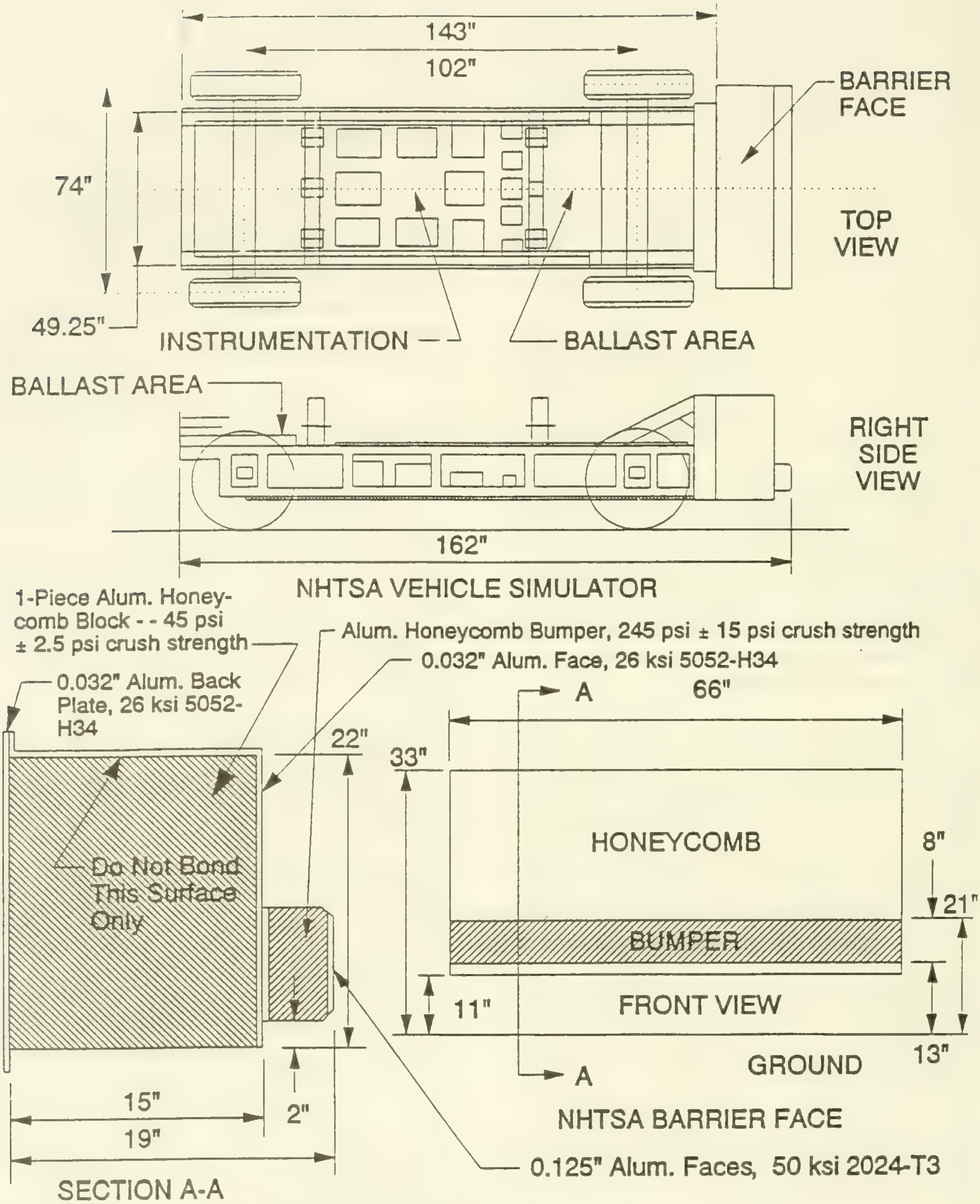


Figure 2—NHTSA Side Impactor-Moving Deformable Barrier

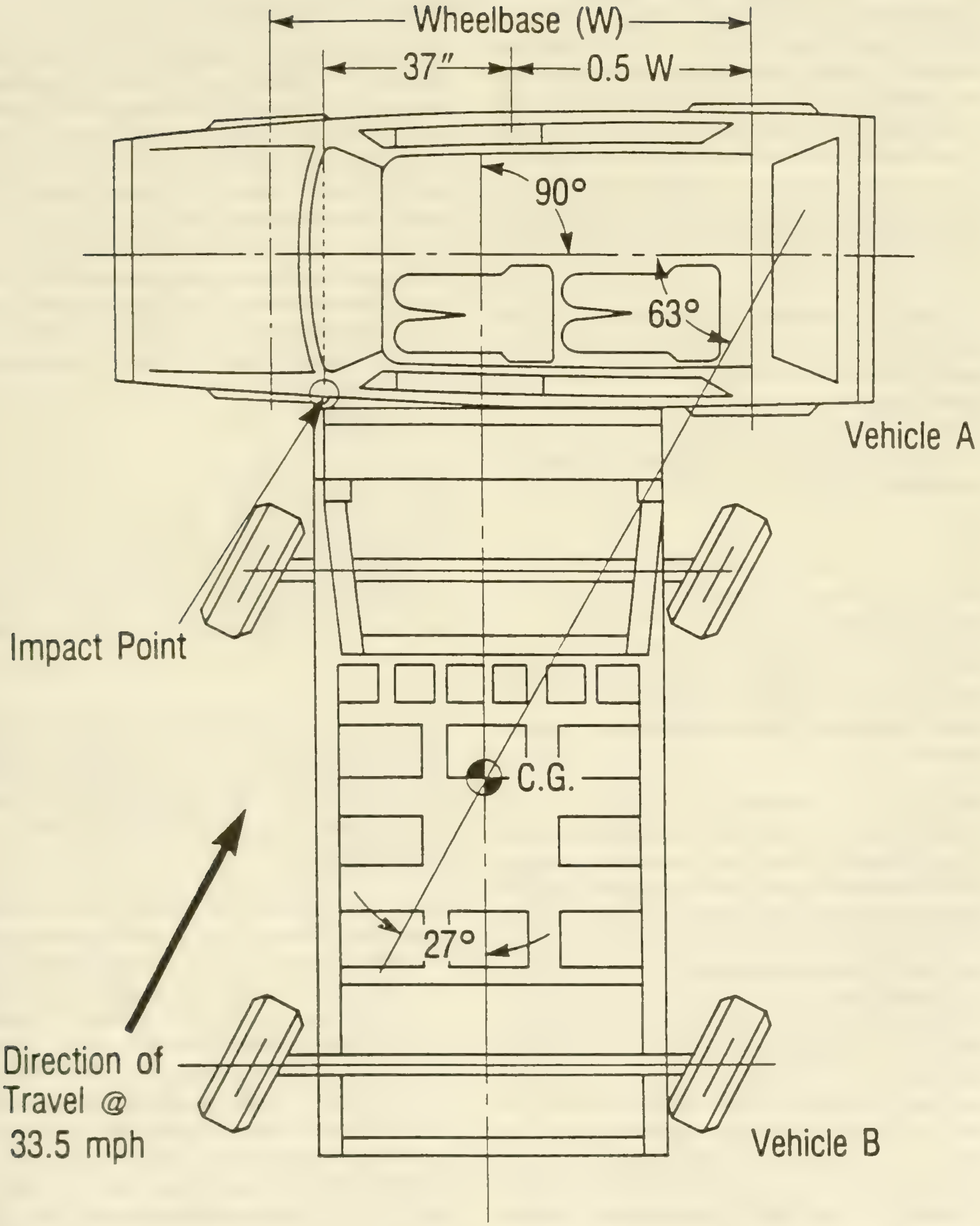


Figure 3—Test Configuration

S6.13 Anthropomorphic test dummies.

S6.13.1 The anthropomorphic test dummies used for evaluation of a vehicle's side impact protection conform to the requirements of Subpart F of Part 572 of this Chapter. In a test in which the test vehicle is to be struck on its left side, each dummy is to be configured and instrumented to be struck on its left side, in accordance with Subpart F of Part 572. In a test in which the test vehicle is to be struck on its right side, each dummy is to be configured and instrumented to be struck on its right side, in accordance with Subpart F of Part 572.

S6.13.2 Each Part 572, Subpart F test dummy specified is clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the test dummy is equipped with a size 11EEE shoe which meets the configuration size, sole, and heel thickness specifications of MIL–S–13192 (1976) and weighs 1.25±0.2 pounds.

S6.13.3 Limb joints are set at between 1 and 2 g's. Leg joints are adjusted with the torso in the supine position.

S6.13.4 The stabilized temperature of the test dummy at the time of the side impact test shall be at any temperature between 66 degrees F and 78 degrees F.

S6.13.5 The acceleration data from the accelerometers mounted on the ribs, spine and pelvis of the test dummy are processed with the FIR100 software specified in 49 CFR Part 572. The data are processed in the following manner—

S6.13.5.1 Filter the data with a 300 Hz, SAE Class 180 filter;

S6.13.5.2 Subsample the data to a 1600 Hz sampling rate;

S6.13.5.3 Remove the bias from subsampled data; and

S6.13.5.4 Filter the data with the FIR100 software specified in 49 CFR Part 572, which has the following characteristics—

S6.13.5.4.1 Passband frequency 100 Hz.

S6.13.5.4.2 Stopband frequency 189 Hz.

S6.13.5.4.3 Stopband gain 50 db.

S6.13.5.4.4 Passband ripple 0.0225 db.

S7 Positioning procedure for the Part 572 Subpart F Test Dummy. Position a correctly configured test dummy, conforming to Subpart F of Part 2 of this Chapter, in the front outboard seating position on the side of the test vehicle to be struck by the moving deformable barrier and position another conforming test dummy in the rear outboard position on the same side of the vehicle, as specified in S7.1 through S7.4. Each test dummy is restrained using all available belt systems in all seating positions where such belt restraints are provided. In addition, any folding armrest is retracted.

S7.1 Torso.

S7.1.1 For a test dummy in the driver position.

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and passes through the center of the steering wheel.

(b) *For a bucket seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket seat.

S7.1.2 For a test dummy in the front outboard passenger position.

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and the same distance from the vehicle's longitudinal centerline as would be the midsagittal plane of a test dummy positioned in the driver position under S7.1.1.

(b) *For a bucket seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket seat.

S7.1.3 For a test dummy in either of the rear outboard passenger positions.

(a) *For a bench seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and, if possible, the same distance from the vehicle's longitudinal centerline as the midsagittal plane of a test dummy positioned in the driver position under S7.1.1. If it is not possible to position the test dummy so that its midsagittal plane is parallel to the vehicle longitudinal centerline and is at this distance from the vehicle's longtitudinal centerline, the test dummy is positioned so that some portion of the test dummy just touches, at or above the seat level, the side surface of the vehicle, such as the upper quarter panel, an armrest, or any interior trim (i.e., either the broad trim panel surface or a smaller, localized trim feature).

(b) *For a bucket or contoured seat.* The upper torso of the test dummy rests against the seat back. The midsagittal plane of the test dummy is vertical and parallel to the vehicle's longitudinal centerline, and coincides with the longitudinal centerline of the bucket or contoured seat.

S7.2 Pelvis.

S7.2.1 H-Point. The H-points of each test dummy coincide within ½ inch in the vertical dimension and ½ inch in the horizontal dimension of a point ¼ inch below the position of the H-point determined by using the equipment for the 50th percentile and procedures specified in SAE J826 (Apr. 80), except that Table 1 of the SAE J826 is not applicable. The length of the lower leg and thigh segments of the H-point machine are adjusted to 16.3 and 15.8 inches, respectively.

S7.2.2 Pelvic angle. As determined using the pelvic angle gauge (GM drawing 78051–532 incorporated by reference in Part 572, Subpart E of this Chapter) which is inserted into the H-point gauging hole of the dummy, the angle of the plane of the surface on the lumbar-pelvic adaptor on which the lumbar spine attaches is 23 to 25 degrees from the horizontal, sloping upward toward the front of the vehicle.

S7.3 Legs.

S7.3.1 For a test dummy in the driver position. The upper legs of each test dummy rest against the seat cushion to the extent permitted by placement of the feet. The left knee of the dummy is positioned such that the distance from the outer surface of the knee pivot bolt to the dummy's midsagittal plane is six inches. To the extent practicable, the left leg of the test dummy is in a vertical longitudinal plane.

S7.3.2 For a test dummy in the outboard passenger positions. The upper legs of each test dummy rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces is 11.5 inches. To the extent practicable, both legs of the test dummies in outboard passenger positions are in vertical longitudinal planes. Final adjustment to accommodate placement of feet in accordance with S7.4 for various passenger compartment configurations is permitted.

S7.4 Feet.

S7.4.1 For a test dummy in the driver position. The right foot of the test dummy rests on the undepressed accelerator with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel.

S7.4.2 For a test dummy in the front outboard passenger position. The feet of the test dummy are placed on the vehicle's toeboard with the heels resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed flat on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible so that the heels rest on the floorpan.

S7.4.3 For a test dummy in either of the rear outboard passenger positions. The feet of the test dummy are placed flat on the floorpan and beneath the front seat as far as possible without front seat interference. If necessary, the distance between the knees can be changed in order to place the feet beneath the seat.

S8 Phase-in of dynamic test and performance requirements.

S8.1 Passenger cars manufactured on or after September 1, 1993 and before September 1, 1994.

S8.1.1 The number of passenger cars complying with the requirements of 53(c) shall be not less than 10 percent of—

(a) The average annual production of passenger cars manufactured on or after September 1,1990, and before September 1, 1993, by each manufacturer; or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.1.

S8.2 Passenger cars manufactured on or after September 1, 1994 and before September 1, 1995.

S8.2.1 The number of passenger cars complying with the requirements of S3(c) shall be not less than 25 percent of—

(a) The average annual production of passenger cars manufactured on or after September 1, 1991, and before September 1, 1994, by each manufacturer; or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.2.

S8.3 Passenger cars manufactured on or after September 1, 1995 and before September 1, 1996.

S8.3.1 The number of passenger cars complying with the requirements of S3(c) shall be not less than 40 percent of—

(a) The average annual production of passenger cars manufactured on or after September 1, 1992, and before September 1, 1995, by each manufacturer; or

(b) The manufacturer's annual production of passenger cars during the period specified in S8.3.

S8.4 Passenger cars produced by more than one manufacturer.

S8.4.1 For the purposes of calculating average annual production of passenger cars for each manufacturer and the number of passenger cars manufactured by each manufacturer under S8.1, S8.2, and S8.3, a passenger car produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S8.4.2—

(a) A passenger car which is imported shall be attributed to the importer.

(b) A passenger car manufactured in the United States by more than one manufacturer, one of which also markets the vehicles, shall be attributed to the manufacturer which markets the vehicle.

S8.4.2 A passenger car produced by more than one manufacturer shall be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 586, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S8.4.1.

[S9 Phase-in of side door strenqth requirements for multipurpose passenqer vehicles, trucks and buses.

[S9.1 Multipurpose passenqer vehicles, trucks and buses manufactured on or after September 1, 1993 and before September 1, 1994.

[S9.1.1 The combined number of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less complying with the requirements of S3(a)(3) shall not be less than 90 percent of—

[(a) The average annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less manufactured on or after September 1, 1990 and before September 1, 1993 by each manufacturer; or

[(b) The manufacturer's annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less during the period specified in S9.1.

[S9.1.2 Walk-in vans, vehicles which do not have any side doors that can be used for occupant egress, vehicles which exclusively have doors of the types specified in S3(e), and vehicles specified in S9.2.3 may be excluded from all calculations of compliance with S9.1.1.

[S9.2 Multipurpose passenger vehicles, trucks and buses produced by more than one manufacturer.

[S9.2.1 For the purposes of calculating average annual production of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less for each manufacturer and the number of multipurpose passenger vehicles, trucks and buses with a GVWR of 10,000 pounds or less manufactured by each manufacturer under S9.1,1, a vehicle produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S9.2.2—

[(a) A vehicle which is imported shall be attributed to the importer.

[(b) A vehicle manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

[S9.2.2 A vehicle produced by more than one manufacturer shall be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 586, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S9.2.1.

[S9.2.3 Each multipurpose passenger vehicle, truck and bus with a GVWR of 10,000 pounds or less that is manufactured in two or more stages or that is altered (within the meaning of § 567.7 of this Chapter) after having previously been certified in accordance with Part 567 of this Chapter is not subject to the requirements of S3(a)(3). **(57 F.R. 30917—July 13, 1992. Effective: September 1, 1993.)]**

July 13, 1992
57 F.R. 30917

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 216

Roof Crush Resistance—Passenger Cars

(Docket No. 2–6; Notice 5)

The purpose of this amendment to Part 571 of Title 49, Code of Federal Regulations, is to add a new Motor Vehicle Safety Standard 216, (49 CFR § 571.216) that sets minimum strength requirements for a passenger car roof to reduce the likelihood of roof collapse in a rollover accident. The standard provides an alternative to conformity with the rollover test of Standard 208.

A notice of proposed rulemaking on this subject was issued on January 6, 1971 (36 F.R. 166). As noted in that proposal, the strength of a vehicle roof affects the integrity of the passenger compartment and the safety of the occupants. A few comments suggested that there is no significant causal relationship between roof deformation and occupant injuries in rollover accidents. However, available data have shown that for non-ejected front seat occupants in rollover accidents, serious injuries are more frequent when the roof collapses.

The roof crush standard will provide protection in rollover accidents by improving the integrity of the door, side window, and windshield retention areas. Preserving the overall structure of the vehicle in a crash decreases the likelihood of occupant ejection, reduces the hazard of occupant interior impacts, and enhances occupant egress after the accident. It has been determined, therefore, that improved roof strength will increase occupant protection in rollover accidents.

Standard 208 (49 CFR § 571.208), *Occupant Crash Protection*, also contains a rollover test requirement for vehicles that conform to the "first option" of providing complete passive protection. The new Standard 216 issued herewith is intended as an alternative to the Standard 208 rollover test, such that manufacturers may conform to either requirement as they choose. Standard 208 is accordingly amended by this notice; the effect of the amendment, together with the new Standard 216, is as follows:

(1) From January 1, 1972, to August 14, 1973, a manufacturer may substitute Standard 216 for the rollover test requirement in the first option of Standard 208; Standard 216 has no mandatory application.

(2) From August 15, 1973, to August 14, 1977, Standard 216 is in effect as to all passenger cars except those conforming by passive means to the rollover test of Standard 208, but it may continue to be substituted for that rollover test.

(3) After August 15, 1977, Standard 216 will no longer be a substitute for the Standard 208 rollover test. It is expected that as of that date Standard 216 will be revoked, at least with respect to its application to passenger cars.

A few comments stated that on some models the strength required in the A pillar could be produced only by designs that impair forward visibility. After review of strengthening options available to manufacturers, the Administration has concluded that a satisfactory increase in strength can be obtained without reducing visibility.

Some comments suggested that the crush limitation be based on the interior deflection of the test vehicle rather than the proposed external criterion. After comparison of the two methods, it has been concluded that a test based on interior deflection would produce results that are significantly less uniform and more difficult to measure, and therefore the requirement based on

external movement of the test block has been retained.

Several changes in detail have been made, however, in the test procedure. A number of comments stated that the surface area of the proposed test device was too small, that the 10-degree pitch angle was too severe, and that the 5 inches of padded test device displacement was not enough to measure the overall roof strength. Later data available after the issuance of the NPRM (Notice 4) substantiated these comments. Accordingly, the dimensions of the test block have been changed from 12 inches square to 30 inches by 72 inches, the face padding on the block has been eliminated, and the pitch angle has been changed from 10 degrees to 5 degrees.

Several manufacturers asked that convertibles be exempted from the standard, stating that it was impracticable for those vehicles to be brought into compliance. The Administration has determined that compliance with the standard would pose extreme difficulties for many convertible models. Accordingly, manufacturers of convertibles need not comply with the standard; however, until August 15, 1977, they may comply with the standard as an alternative to conformity with the rollover test of Standard 208.

A few comments objected to the optional 5,000-pound ceiling to the requirement that the roof have a peak resistance of 1½ times the unloaded vehicle weight. Such objections have some merit, if the energy to be dissipated during a rollover accident must be absorbed entirely by the crash vehicle. In the typical rollover accident, however, in which the vehicle rolls onto the road shoulder, significant amounts of energy are absorbed by the ground. This is particularly true in heavier vehicles. Some of the heavier vehicles, moreover, would require extensive redesign, at a considerably greater cost penalty than in the case of lighter vehicles, to meet a strength requirement of 1½ times their weight. At the same time, heavier vehicles generally have a lower rollover tendency than do lighter vehicles. On the basis of these factors, it has been determined that an upper limit of 5,000 pounds on the strength requirement is justified, and it has been retained.

It was requested that the requirement of mounting the chassis horizontally be deleted. It has been determined that the horizontal mounting position contributes to the repeatability of the test procedure and the requirement is therefore retained.

The required loading rate has been clarified in light of the comments. The requirement has been changed from a rate not to exceed 200 pounds per second to a loading device travel rate not exceeding one-half inch per second, with completion of the test within 120 seconds.

A number of manufacturers requested that repetition of the test on the opposite front corner of the roof be deleted. It has been determined that, as long as it is clear that both the left and right front portions of the vehicle's roof structure must be capable of meeting the requirements, it is not necessary that a given vehicle be capable of sustaining successive force applications at the two different locations. The second test is accordingly deleted.

Effective date: August 15, 1973. After evaluation of the comments and other information, it has been determined that the structural changes required by the standard will be such that many manufacturers would be unable to meet the requirements if the January 1, 1973 effective date were retained. It has therefore been found, for good cause shown, that an effective date more than one year after issuance is in the public interest. On or after January 1, 1972, however, a manufacturer may substitute compliance with this standard for compliance with the rollover test requirement of Standard 208.

In consideration of the above, the following changes are made in Part 571 of Title 49, Code of Federal Regulations:

1. Standard No. 208, 49 CFR § 571.208, is amended by adding the following sentence at the end of S5.3, *Rollover:* "However, vehicles manufactured before August 15, 1977, that conform to the requirements of Standard No. 216 (§ 571.216) need not conform to this rollover test requirement."

2. A new § 571.216, Standard No. 216 *Roof Crush Resistance*, is added. . . .

This rule is issued under the authority of sections 103 and 119 of the National Traffic and Motor Vehicle Safety Act, 15 U.S.C. 1392, 1407, and the delegation of authority at 49 CFR 1.51.

Issued on December 3, 1971.

Charles H. Hartman
Acting Administrator

36 F.R. 23299
December 8, 1971

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 216

Roof Crush Resistance

(Docket No. 69-7; Notice 29)

The purpose of this notice is to postpone the effective date of the requirements of Standards No. 208, Occupant Crash Protection, and 216, Roof Crush Resistance, applicable to the upcoming model year, from August 15, 1973, to September 1, 1973.

The amendment of the effective date was proposed in a notice published July 17, 1973 (38 F.R. 19049), in response to a petition filed by Chrysler Corporation. Chrysler had stated that the build out of their 1973 models was in danger of running beyond the August 15 date, due to a variety of factors beyond the company's control. In proposing the postponement of the date, the NHTSA noted that the August 15 date had been chosen to coincide with the normal changeover date and that a delay would not appear to have any effect beyond allowing a slightly prolonged build-out.

The two comments submitted in response to the proposal were both favorable. The agency has not discovered any adverse consequences of a delay which would make it inadvisable, and has therefore decided to postpone the effective date as proposed.

In light of the foregoing, 49 CFR 571.208, Standard No. 208, Occupant Crash Protection, is amended by changing the date of August 14, 1973, appearing in S4.1.1 to August 31, 1973, and by changing the date of August 15, 1973, appearing in S4.1.2 to September 1, 1973. The effective date of 49 CFR 571.216, Standard No. 216, Roof Crush Resistance, is changed from August 15, 1973, to September 1, 1973.

Because this amendment relieves a restriction and imposes no additional burden, an effective date of less than 30 days from the date of issuance is found to be in the public interest.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718, 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.51.)

Issued on August 10, 1973.

James B. Gregory
Administrator

38 F.R. 21930
August 14, 1973

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 216

Roof Crush Resistance

(Docket No. 89-22; Notice 03)
RIN: 2127-AC13

ACTION: Final rule.

SUMMARY: This notice amends Federal Motor Vehicle Safety Standard No. 216, Roof Crush Resistance, to extend its requirements to light trucks with a gross vehicle weight rating (GVWR) of 6,000 pounds or less. The standard currently applies to passenger cars only. The extension is, in part, a response to the increasing sales of light trucks and the increasing use of those vehicles to transport people instead of or in addition to property.

NHTSA proposed to extend Standard No. 216 to light trucks with a GVWR of 10,000 pounds or less. However, comments on the proposal raised issues concerning the feasibility of extending the standard to light trucks with a GVWR between 6,000 and 10,000 pounds. NHTSA will investigate those issues further and may possibly conduct future rulemaking concerning such light trucks. This final rule and other similar rulemakings are part of NHTSA's effort to ensure that occupants of light trucks are adequately protected.

DATES: The amendments made by this final rule to the *Code of Federal Regulations* are effective September 1, 1993.

SUPPLEMENTARY INFORMATION:

I. Background

Standard No. 216 is intended to reduce deaths and injuries due to the crushing of the roof into the passenger compartment in rollover crashes. The standard currently establishes strength requirements for the forward portion of the roof (i.e., the area most likely to sustain severe damage in a rollover crash) of passenger cars, to increase the resistance of the roof to crush and intrusion.

In the test specified by Standard No. 216, the roof of a stationary vehicle is subjected to a force of 1½ times the unloaded weight of the vehicle or 5,000 pounds, whichever is less. This force is gradually applied by a rigid test device in a static test. To pass the test, the roof structure must be strong enough so that the device does not depress more than five inches during the test. Standard No. 216 currently applies to passenger cars, but not to light trucks, for the reasons stated in NHTSA's April 1988 light truck report to Congress entitled, "Safety Programs for Light Trucks and Multipurpose Passenger Vehicles":

> In the early years of NHTSA's existence, the regulatory and research approach was based on a clear distinction between the design and intended purpose of passenger cars and light trucks. Unlike passenger cars, light trucks were designed and used primarily as cargo-carrying vehicles rather than as people-carrying vehicles. In addition, because light trucks were structurally different than passenger cars, the agency anticipated that occupants of light trucks would not be as vulnerable to injuries as passenger car occupants. Also, car occupants suffered far more deaths and injuries than did occupants of light trucks. Thus, the initial standards concentrated on requirements for passenger cars so that the agency could reduce deaths and injuries in those vehicles.

There have been substantial changes in the number and use of light trucks. In 1988, light trucks captured approximately 29 percent of the total retail sales for cars and light trucks. Statistics from the Federal Highway Administration show that light truck registrations in 1988 had increased 25 percent since 1982. Travel by 2-axle, 4-tire trucks, which closely correspond to the class of vehicles in this rulemaking, has increased by over 250 percent compared to 1970. From 1977 to 1985, the percentage of light trucks in the compact category increased from 10.2 percent to 52.6 percent.

The Census Bureau's "Truck Inventory and Use Survey" shows that the percentage of pickup truck use for personal transportation purposes increased from 51 percent in 1967 to 66 percent in 1982 and that the percentage of use for agricultural purposes decreased from 26 percent to 12 percent in the same time period.

NHTSA has noted that the greater use of light trucks as passenger carrying vehicles is leading to increases in the number of light trucks and vans on the road, the number of persons transported in such vehicles, and consequently, the number of persons exposed to crashes in those vehicles.

On November 2, 1989, NHTSA proposed to extend the requirements of Standard No. 216 to light trucks with a gross vehicle weight rating (GVWR) of 10,000 pounds or less. (As used in this document, the term "light trucks" includes trucks, buses, vans and other multipurpose passenger vehicles (MPV's) with a gross vehicle weight rating (GVWR) of either 10,000 pounds or less or 6,000 pounds or less, depending upon the context.) The proposal was part of NHTSA's efforts to ensure that occupants of light trucks are adequately protected, particularly in rollovers. Under the proposal, light trucks would have been required to withstand a force of 1½ times their unloaded weight. Unlike the force applied to passenger cars, the force applied to light trucks would not have been limited by a 5,000 pound maximum. The proposal did not include school buses since they must already comply with roof crush protection requirements in Standard No. 220, School Bus Rollover Protection. The effective date for this amendment to Standard No. 216 would have been September 1, 1991.

II. Brief Summary of Comments on Proposal

The public comments on the proposed rule are briefly summarized below. NHTSA more fully summarizes and responds to those comments later in this notice and in the Final Regulatory Evaluation. Some of the comments supported the proposed amendment or stated that the commenter had no objection to the proposal, while others opposed certain aspects of the proposal.

The majority of commenters suggested that the standard not be extended to all light trucks with a GVWR of 10,000 pounds or less. Some commenters opposed the extension of the standard to vehicles such as vans, van conversions, and motor homes. Other commenters opposed the extension to vehicles over a certain GVWR (e.g., 8,500 pounds, 6,000 pounds, or 5,500 pounds). One commenter opposed extension of the standard to commercial and vocational trucks produced in two or more stages and designed to carry cargo or work-related equipment. This commenter and others discussed certification problems that they believed would be experienced by final-stage manufacturers as a result of extending the standard.

A number of commenters urged that the roof crush test force for light trucks be subject to the same 5,000 pound limit that currently applies to the test for passenger cars. Some commenters suggested that NHTSA adopt a test force of the lesser of 5,000 pounds or the GVWR of the light truck.

Some commenters suggested that NHTSA adopt the roof crush test of Standard No. 220, School Bus Rollover Protection, for certain light trucks or otherwise modify the proposed roof crush procedure to take into account special characteristics and features of motor homes, vans, and van conversions.

III. Summary of the Final Rule

After considering the comments and other available information, NHTSA has decided to adopt its proposal to extend Standard No. 216 to light trucks, but to do so in a way that differs in two significant respects from that proposal. The GVWR limitation on the affected vehicles is 6,000 pounds instead of the proposed 10,000 pound cut-off. In addition, this amendment to the standard is effective September 1, 1993, rather than the proposed date of September 1, 1991. The final rule establishes the same test procedure as proposed. Below, NHTSA discusses in greater detail the contents of the final rule and the reasons for its adoption.

IV. Safety Need

NHTSA stated in the proposal that there has been a convergence between light trucks and passenger cars, both in their structure (with many trucks in the compact size range) and in their use (with many trucks used for personal transportation rather than cargo). NHTSA believed that these changes point strongly toward the need to reevaluate the standards applicable to light trucks. NHTSA has responded to these changes regarding light trucks by evaluating the degree to which occupant safety in light trucks can be improved through the extension of existing passenger car standards to those vehicles. In conducting this evaluation, NHTSA was mindful that it is required by the National Traffic and Motor Vehicle Safety Act to ensure that each standard is appropriate for the vehicle type to which it applies.

In the case of Standard No. 216, the agency observed a significantly greater incidence of rollover crashes per registered vehicle for light trucks than for passenger cars. NHTSA stated in the proposal that rollover protection requirements are especially important for light trucks in view of traffic crash data which show that the light truck fatality rate (per registered vehicle) in rollovers is approximately twice that for passenger cars.

General Motors Corporation (GM), while not opposing an extension of Standard No. 216 to light trucks with a GVWR of 8,500 pounds or less, disagreed with NHTSA's analysis of the safety need for the proposal. GM believes that studies have demonstrated the lack of a causal relationship between roof crush and occupant injury in rollover accidents. According to GM, occupant injury causation in rollovers results primarily

from ejection or occupant impact with the vehicle interior. According to GM, the most effective method to mitigate injury in rollovers is for occupants to use occupant restraints properly.

NHTSA agrees that a principal cause of the high fatality rate in light truck rollover crashes is occupant ejection. Over two-thirds of the light truck occupants killed in rollover accidents are ejected from the vehicle. NHTSA believes that the number of fatalities in rollovers can be reduced by reducing the number of occupants ejected in such crashes through increasing the use of safety belts. However, efforts to increase occupant safety through the increased use of safety belts can only be beneficial if those benefits are not negated by collapse of the passenger compartment in a rollover crash. NHTSA believes that amending Standard No. 216 to set requirements for light trucks to prevent collapse of the passenger compartment will complement regulatory and other actions directed toward reducing ejections in rollovers.

The Insurance Institute for Highway Safety (IIHS) agreed with NHTSA concerning the safety need for extending the requirements of Standard No. 216 to light trucks. According to IIHS, light trucks are disproportionately involved in fatal rollover accidents. IIHS stated that, in 1988, the death rate in single vehicle crashes for small pickups (weight less than 3,500 pounds) was twice the overall average for vehicles (1.9 compared to 0.9). According to IIHS, rollover was involved in 39 percent of these crashes. IIHS stated that for small utility vehicles (wheelbase less than 100 inches), the death rate was again twice the overall average (2.1 compared to 0.9) and rollover crashes were involved in 65 percent of the deaths. According to IIHS, the safety need for the extension of the standard is further demonstrated by NHTSA's analysis showing crush intrusion is greater for light trucks than for passenger cars.

Other commenters questioned the need to extend the standard to certain types or sizes of light trucks. NHTSA responds to those comments in Part V below.

V. Vehicle Population

NHTSA proposed that Standard No. 216 be extended to light trucks having a GVWR of 10,000 pounds or less. The NPRM specifically requested comment on the effects of limiting the extension to light trucks with a GVWR of 8,500 pounds or less and the impact of these different GVWR cut-offs on final-stage manufacturers and alterers.

Volvo Cars of North America (Volvo) explicitly supported the extension of the standard to light trucks up to 10,000 pounds GVWR. In addition, Nissan Research and Development, Inc. (Nissan), Volkswagen of America, Inc. (Volkswagen), and the Insurance Institute for Highway Safety (IIHS) implicitly supported such an extension since they supported the proposed rule without reservation.

Other commenters did not support extending the standard as proposed. Some suggested extending it only to light trucks with a certain GVWR (i.e., 8,500 pounds, 6,000 pounds, or 5,500 pounds), while others suggested extending it only to certain types of light trucks. GM and Ford Motor Company (Ford) supported extension of the standard only to light trucks with a GVWR of 8,500 pounds or less. The Recreation Vehicle Industry Association (RVIA) urged NHTSA to exclude motor homes, vans, and van conversions from the standard. If those types of vehicles are not generally excluded, RVIA urged NHTSA to exclude those that have a GVWR of more than 6,000 pounds. A number of individual companies made similar comments and one, Kentron, Inc., suggested a cut-off of 5,500 pounds GVWR. The National Truck Equipment Association (NTEA) supported the extension of Standard No. 216 to light trucks used as passenger vehicles, but opposed extension to commercial and vocational light trucks produced in two or more stages and designed to carry cargo or work-related equipment. NTEA stated that if NHTSA does not exclude such light trucks from the standard, extending the standard only to light trucks with a GVWR of 8,500 pounds or less would provide significant relief, compared to the proposal.

NHTSA has decided to extend the requirements of Standard No. 216 to light trucks with a GVWR of 6,000 pounds or less in this rulemaking. NHTSA needs additional time to assess the feasibility of applying the standard to light trucks with higher GVWR's. NHTSA may address these light trucks in possible future rulemaking.

NHTSA is covering all types of light trucks in the final rule, with the exception of school buses, which are already covered by Standard No. 220. Thus, NHTSA did not follow the suggestions of some commenters to exclude certain types of light trucks from the rule. NHTSA believes that the concerns raised by these commenters about the practicality of the requirements will be adequately addressed by extending the standard only to cover light trucks with a GVWR of 6,000 pounds or less in this rulemaking. The types of vehicles that commenters thought should be excluded from the standard generally have a GVWR greater than 6,000 pounds and are thus excluded by this limit.

As mentioned above, NTEA suggested excluding certain vehicles produced in two or more stages from Standard No. 216. NTEA claimed that NHTSA "has not established . . . that the rollover accident fatality or injury rate for commercial or vocational trucks produced in two or more stages warrants the imposition of expensive and burdensome testing requirements." In the Final Regulatory Impact Analysis,

NHTSA has analyzed the potential safety benefits of this final rule. However, NHTSA disagrees with the premise that the agency must quantify the magnitude of the safety problem and the safety benefits gained through adoption or extension of a safety standard for every conceivable subclass of a particular type of vehicle. NTEA apparently believes that NHTSA must demonstrate through analysis of crash data that there is a safety need to protect occupants of every conceivable subclass of light truck (e.g., tow trucks, ambulances, bread delivery vehicles, public utility vehicles, snow plows, dump trucks, etc.). Crash data broken down by such discrete subclasses of light trucks are not available. Even if such detailed data were available, the data cells would likely be too small to draw statistically valid conclusions.

However, the National Traffic and Motor Vehicle Safety Act does not require this degree of specificity. Section 103(f)(3) of the Safety Act requires that a safety standard be "appropriate for the particular type of motor vehicle . . . for which it is prescribed." In 49 CFR 571.3, NHTSA has defined the types of motor vehicles and, for this rulemaking, the relevant vehicle types include trucks, multi-purpose passenger vehicles (MPV's), and buses with a GVWR of 6,000 pounds or less. NTEA's assertion that vehicles manufactured in more than one stage constitute a separate type of vehicle is not substantiated and runs counter to the Safety Act's legislative history. The Senate Report states that differences in safety standards "would be based on the type of vehicle rather than its place of origin or any special circumstances of its manufacture." S. Rep. No. 1301 (89th Cong., 2d Sess.) at 6.

In its comments, NTEA did not explain how its members' vehicles either offer improved roof crush protection or why the occupants of such vehicles do not require such protection. NTEA provided no data or even anecdotal information to support its position that the extension of Standard No. 216 to vehicles manufactured by its members is not necessary. Since these vehicles are driven on the same roads and at the same times as other light trucks, they are subject to the same safety risks as other light trucks, absent some special vehicle characteristic that would reduce such risks. Indeed, the risk to occupants of many vehicles produced by NTEA members may even exceed that to occupants of other light trucks. For example, occupants of vehicles used for emergency or rescue purposes (e.g., ambulances and tow trucks) may be at greater risk than occupants of other light trucks.

NTEA argues that because vehicles manufactured by its members are not intended to transport passengers and because they "are driven by professionals who are more likely to be aware of the benefits derived by safety belt use," there is less safety need to apply Standard No. 216 to such vehicles. First, NTEA submitted no information showing that drivers of light trucks manufactured by its members are more likely to use safety belts. In fact, overall safety belt use is lower for light truck drivers than for passenger car drivers. Second, as discussed above, efforts to increase occupant safety through increased use of safety belts can only be beneficial if those benefits are not negated by collapse of the passenger compartment in a rollover crash. Thus, the extension of Standard No. 216 to the light trucks manufactured by NTEA's members will complement efforts to reduce ejections by increased use of safety belts. Third, many light trucks manufactured by NTEA's members typically have passengers. Examples of such vehicles include ambulances (where an injured or ill person and a medical technician are typical passengers), tow trucks (where the disabled vehicle's driver is a typical passenger), and utility vehicles (which often have a two-person crew). Fourth, even if a light truck does not typically have passengers, NHTSA is still concerned about the risk to the driver. Indeed, 70 percent of all fatalities in light truck crashes are drivers. Finally, NTEA does not show that light trucks manufactured by its members are somehow safer because their drivers are "professionals." NTEA submitted no information about any special training or licensing requirements for operators of such light trucks and NHTSA is not aware of any such requirements.

Further, there is a legal issue concerning whether NHTSA is able to exclude vehicles produced in two or more stages from Standard No. 216. The court stated in *Chrysler Corp. v. Dept. of Transportation* that any differences between standards for different classes of vehicles are to "be based on type of vehicle rather than its place of origin or any special circumstances of its manufacturer." 472 F.2d 659, 679 (6th Cir. 1972). Thus, under this decision, NHTSA may not exclude vehicles from Standard No. 216 simply because they are manufactured in two or more stages. NHTSA acknowledges that a recent decision in *National Truck Equipment Association v. NHTSA*, ____ F.2d____ (6th Cir. 1990), seems to indicate that NHTSA does have authority to exclude commercial vehicles manufactured in two or more stages from coverage under a safety standard. However, even if authority can be found in the statute for such an approach, NHTSA does not believe that the approach would be appropriate here. NHTSA believes that the occupants of light trucks manufactured in two or more stages should be provided the same protection against roof crush as occupants of other light trucks. In Unit VII below, NHTSA discusses ways that final-stage manufacturers and alterers may comply with Standard No. 216.

NHTSA also received a comment from Chrysler stating that it considers the Jeep Wrangler, which is designed as an open-body vehicle, to be a convertible,

and thus excluded from Standard No. 216. More recently, Chrysler submitted a request for a rule interpretation on the same issue. Convertibles are excluded from Standard No. 216. NHTSA has defined "open-body type vehicle" to mean "a vehicle having no occupant compartment top or an occupant compartment top that can be installed or removed by the user at his convenience." 49 CFR 571.3. In many previous interpretations and preambles, NHTSA has defined convertible as "a vehicle whose A-pillar or windshield peripheral support is not joined at the top with the B-pillar or another rear roof support rearward of the B-pillar by a fixed rigid structural member." As the terms are defined by NHTSA, "open-body type vehicles" are a subset of the class of vehicles considered "convertibles." Thus, if the Jeep Wrangler is an "open-body type vehicle," as stated by Chrysler, that vehicle would also be considered a "convertible" for purposes of the safety standards.

VI. Test Procedure

The final rule establishes the same test procedure as proposed. The final rule requires that the roof of a light truck covered by the standard be able to sustain a displacement of no more than five inches when a force of 1½ times the vehicle's unloaded weight is applied to either side of the forward edge of the vehicle's roof. The test is the same as the one currently required for passenger cars, with one exception. For light trucks under this rule, there is no 5,000 pound ceiling for the roof crush test force as there is for passenger cars.

A. Roof Crush Test Force

NHTSA received a number of comments concerning the proposed roof crush test force. Nissan commented that it did not oppose elimination of the 5,000 pound test force limit. GM, Chrysler, Ford, RVIA, NTEA, Sherrod Vans, Inc. (Sherrod), and Kentron opposed elimination of the 5,000 pound test force limit. Chrysler asserted that the elimination of the 5,000 pound limit would make the test more stringent for light trucks than for passenger cars and that NHTSA did not justify the need for this. Ford and NTEA thought that the elimination of the 5,000 pound test force limit would burden final-stage manufacturers. GM suggested that requiring a test force equal to the GVWR of the light truck, with a 5,000 pound limit, would simplify validation testing. RVIA, Sherrod, and Kentron also supported requiring a test force equal to the GVWR of the vehicle, with a 5,000 pound limit.

After considering the comments, NHTSA has decided to adopt the proposed roof crush test force requirements. The requirements are the same as for passenger cars, except that the 5,000 pound roof crush force ceiling is not adopted for light trucks. NHTSA believes that to adopt a standard for light trucks that is equivalent to that for passenger cars, it cannot adopt the 5,000 pound ceiling currently allowed for passenger cars. Only a small portion of passenger cars currently weigh enough to take advantage of the 5,000 pound ceiling. They are generally heavier cars with low rollover rates. Because trucks are generally much heavier as a group, a large portion of the light truck population, which does have a high rollover rate, would have been able to comply using the 5,000 pound ceiling that applies for passenger cars. Since nearly all passenger cars must comply with Standard No. 216 at a force 1½ times their unloaded weight, allowing light trucks to utilize the 5,000 pound ceiling would establish a weaker standard for light trucks than for passenger cars.

NHTSA did not adopt the GM suggestion to have the test force equal the GVWR of the light truck because that was outside the scope of the proposal. However, NHTSA will consider whether it is appropriate to propose such a change and may address this as part of the possible future rulemaking discussed above.

B. Other Aspects of the Test Procedure

In addition to comments on the roof crush force, NHTSA also received a number of comments on other aspects of the roof crush test procedure. RVIA suggested that NHTSA modify the roof crush test procedures to take into account special characteristics and features of motor homes, vans, and van conversions. Other commenters made similar suggestions. Ford questioned the need for a five-inch roof crush limitation for vehicles with full standing headroom and suggested that NHTSA consider relating the maximum roof crush requirement to the occupant space available. Other commenters made similar suggestions. Grumman Olsen (Grumman) suggested that the test procedure in Standard No. 220, School Bus Rollover Protection, would be more appropriate for walk-in vans and cargo vans. Mark III Industries (Mark III) suggested that the test procedures of Standard No. 220 would be more appropriate for van conversions. Mark III asserted that the Standard No. 216 procedure tests the integrity of the original equipment manufacturer's chassis, rather than the structural integrity of the raised roof installed by the van converter. Mark III further asserted that the Standard No. 220 procedure tests the integrity of the raised roof as well as the structural integrity of the chassis. Ford suggested that the test procedure specified in the current Standard No. 216 could place the test platen at the corner of the cargo box in some vehicles and over the rear raised roof section in some other vehicles. Other commenters stated that it may be difficult to follow the current test procedure on some vehicle roofs that have been altered. Ford suggested an amendment to the standard to specify the positioning of the test platen differently.

NHTSA believes that all of the above issues raised by commenters, concerning alternative test procedures and requirements, merit further consideration by the agency. However, based on other information submitted by commenters, the agency believes that these issues are significant primarily for light trucks with a GVWR of over 6,000 pounds. Therefore, NHTSA is not adopting any changes in the test procedure as part of this rulemaking. However, NHTSA will analyze these issues further and may decide to propose amendments to the test procedure as part of the possible future rulemaking discussed above.

Ford also suggested that NHTSA clarify the meaning of section S6.1 of Standard No. 216 as it will apply to light trucks. Section S6.1 currently states: "Place the sills or the chassis frame of the vehicle on a rigid horizontal surface. . . ."

Ford believes that at least some light trucks should be tested while supported at the sills, rather than the chassis frame. Many light trucks have a narrow frame. Ford found that when some light truck models covered by this final rule were tested with the chassis frame mounted, there was an elastic deformation of the rubber body mounts of the vehicle. When the same light trucks were tested with the sills mounted, there was no such deformation. Ford believes that testing these light trucks with the sills mounted is in keeping with the intent of Standard No. 216 (i.e., to measure roof crush resistance). However, testing these light trucks with the chassis frame mounted may not provide a good indication of roof crush strength since the test procedure would also cause deformation of the rubber body mounts.

NHTSA agrees with Ford that, in at least some cases, it is best to test light trucks with the sills, rather than the chassis frame, mounted on the rigid horizontal surface. This approach may best test the roof crush strength of a light truck. NHTSA intends to conduct its compliance testing of light trucks with the sills mounted.

VII. Leadtime

NHTSA proposed that Standard No. 216 be extended to light trucks effective September 1, 1991. NHTSA tentatively concluded in the proposal that the widespread voluntary compliance with the requirements of Standard No. 216 by manufacturers of light trucks demonstrated the availability of the engineering and manufacturing resources needed to implement the rule by the proposed effective date.

NHTSA received a number of comments concerning leadtime. IIHS considered the proposed leadtime to be adequate. Chrysler stated that it could comply with a rule extending the current requirements for passenger cars in Standard No. 216 to light trucks by September 1, 1991, if the final rule was promulgated by July 1, 1990. However, Chrysler stated that it would have to redesign and retool the A-pillar, roof rail, and other related body components on most of its light trucks to comply with the proposed requirements. Chrysler further stated that it would need at least two years following publication of the final rule to comply with the proposed requirements. Ford commented that all of its light trucks with a GVWR of 8,500 pounds or less would meet the proposed requirements. However, some of Ford's light trucks with a GVWR over 8,500 pounds would not meet the proposed requirements. NTEA commented that if the 8,500 pound GVWR threshold were adopted and multi-stage work-related vehicles were included, multi-stage manufacturers would need at least six months additional leadtime than that provided to manufacturers of incomplete vehicles. NTEA stated that final and intermediate stage manufacturers can begin their design efforts for compliance with a safety standard only after a vehicle model is introduced and the chassis manufacturer's guidelines for completing the vehicle are published.

GM commented that there was no reasonable basis for NHTSA to conclude in the proposal that the majority of light trucks already met the requirements of the proposed rule. GM stated that light trucks with a GVWR over 8,500 pounds would have more difficulty complying with the proposal if it were adopted.

After the close of the comment period, GM submitted information indicating that three of its current light truck model lines may not be in compliance with the proposed requirements of Standard No. 216. According to GM, these three model lines did not demonstrate, in their limited testing, the required margin of compliance necessary to account for test variability and product variability. GM considers such a performance margin essential to ensure that each vehicle would be found in compliance if tested. GM states that the design modifications, which may be required to assure reasonable compliance margins, would require a tooling leadtime of 45 weeks and cost $750,000. According to GM, the added cost per vehicle would be an additional $9.00. GM suggested an effective date of January 1, 1993 to permit it to replace these vehicles with new model lines, rather than modify the current vehicles. According to GM, the successor vehicles will not be available to dealers until the end of the 1992 calendar year.

While NHTSA believes that the proposed leadtime may be appropriate for some of the light trucks that are covered by this final rule, a number of commenters pointed out problems complying with the proposed requirements by September 1, 1991. A number of light trucks with a GVWR of 6,000 pounds or less do not currently meet the requirements that are being adopted in this final rule. The manufacturers of such

vehicles must redesign the vehicles and carry out the necessary retooling. In addition, there are a number of final-stage manufacturers, many of which are small businesses, which need more leadtime than originally proposed to determine how to certify compliance with the standard. (NTEA stated that virtually all of the over 2,000 distributors and manufacturers of multi-stage commercial vehicles are small businesses. RVIA stated that many of its 650 members who manufacture recreational vehicles are also small businesses.) These manufacturers must determine compliance for a variety of commercial and recreational vehicle types. Some of these vehicles must be redesigned. This could involve extensive changes, such as substitution of steel for fiberglass or the inclusion of roll cages. Final-stage manufacturers may not be able to initiate their compliance work until the chassis manufacturers publish their guidelines for completing vehicles in compliance with the amended standard and make those vehicles available. In view of this, NHTSA believes that it is appropriate to establish an effective date of September 1, 1993 for this amendment. Therefore, for the good cause shown, NHTSA finds that it is in the public interest to have an effective date later than one year after promulgation of the rule.

VIII. Compliance by Multi-Stage Manufacturers

In the proposal, NHTSA addressed the issue of light trucks that are manufactured in more than one stage or altered after they are certified by the original manufacturer. There are a number of final-stage manufacturers, many of which are small businesses, involved in installing truck bodies and/or work-related equipment on chassis. There are also a number of alterers involved in modifying the structure of new vehicles. Based on information from commenters, the majority of such vehicles have a GVWR greater than 6,000 pounds. Under NHTSA's regulations, a final-stage manufacturer must certify that the completed vehicle conforms to all applicable safety standards and alterers must certify that the altered vehicle continues to comply with all applicable safety standards.

In the proposal, NHTSA tentatively concluded that the task these final-stage manufacturers and alterers would face in certifying compliance with the proposed requirements of Standard No. 216 would not differ significantly from the tasks they already face in certifying compliance with other standards. In comments on the proposal, NTEA stated that NHTSA underestimated the number of light trucks that manufacturers would have to recertify for compliance with Standard No. 216. NTEA stated that extending Standard No. 216 to only light trucks with a GVWR of 8,500 pounds or less, instead of 10,000 pounds or less, would provide final-stage manufacturers significant relief. NTEA further stated that there currently are no vehicles with a GVWR of 6,000 pounds or less that are assembled from incomplete chassis cabs. RVIA commented that it thought the proposed requirements would have a severe adverse economic impact on van-converters. RVIA thought that limiting coverage of the standard to vehicles with a GVWR of 6,000 pounds or less would substantially reduce the economic consequences to its members.

NHTSA believes that limiting the coverage of the standard to light trucks with a GVWR of 6,000 pounds or less will greatly lessen the problems cited by NTEA and RVIA. However, since some final-stage manufacturers and alterers are covered by this final rule, NHTSA below outlines ways that final-stage manufacturers and alterers may certify compliance.

NHTSA recognizes that final-stage manufacturers and alterers often do not have the engineering or financial resources to conduct their own testing of the vehicles they have completed. However, testing is not necessarily required for vehicle certification and each manufacturer is not required to conduct testing individually. Instead, the National Traffic and Motor Vehicle Safety Act permits manufacturers, including final-stage manufacturers and alterers, to use other means to certify their vehicles, provided that due care is exercised in making the determination of compliance with the Federal Motor Vehicle Safety Standards. (Throughout the rest of this Unit, the term "final-stage manufacturer" is used to refer to both final-stage manufacturers and alterers.)

First, the final-stage manufacturer could stay within the limits set by the incomplete vehicle manufacturer. NHTSA's certification regulations require that the manufacturers of truck chassis used by final-stage manufacturers provide information regarding the limitations on the center of gravity, weight, and other attributes that must be observed in completing the vehicle so as not to affect the vehicle's compliance with the safety standards. Incomplete vehicle manufacturers which produce chassis cabs must certify that their vehicles comply with applicable safety standards. Incomplete vehicle manufacturers which produce other vehicles that are not chassis cabs, e.g., cutaway chassis or stripped chassis, are not required under NHTSA regulations to certify that their incomplete vehicles comply with safety standards. However, such manufacturers must provide subsequent stage manufacturers with an "incomplete vehicle document" that describes the limits within which the vehicle can be modified and still remain in compliance with safety standards. When the final-stage manufacturer observes the limits set by the incomplete vehicle manufacturer, it simply states that fact on the certification label. Under those circumstances, its certification of the vehicle's compliance with the safety standards is based on staying within the limits set by the incomplete vehicle manufacturer.

Thus, if the final-stage manufacturer observes all of the limits specified by the incomplete vehicle manufacturer, the final-stage manufacturer does not have to conduct any testing or analysis to support its certification that the vehicle complies with the safety standards.

NTEA indicated that there are no commercial light trucks with a GVWR of 6,000 pounds or less that are assembled from an incomplete chassis. Therefore, by limiting the coverage of Standard No. 216 to light trucks with a GVWR of 6,000 pounds or less, NHTSA is excluding vehicles from which certification by final-stage manufacturers is automatically required. Whether there must be recertification by the final-stage manufacturer will depend on the extent of the modifications made by the final-stage manufacturer and the requirements of the original manufacturer's certification. NHTSA believes that final-stage manufacturers will often be able to pass through the certification for vehicles assembled from pickup box removal programs and from completed chassis cabs. NHTSA recognizes that recertification may be necessary if final-stage manufacturers add weight which exceeds manufacturer certification limits or make direct roof modifications.

Second, if the final-stage manufacturer cannot stay within the incomplete vehicle manufacturer's limits in using a given chassis to produce a particular sort of completed vehicle, the final-stage manufacturer may choose to use another chassis with greater limits to produce the same sort of vehicle. This option is most relevant when the final-stage manufacturer adds weight to the vehicle. By switching to a different chassis and staying within the incomplete vehicle manufacturer's limits for that chassis, the final-stage manufacturer may avoid the possible necessity of conducting additional testing or engineering analysis to support its certification that the completed vehicle conformed to all safety standards. It could be argued that a final-stage manufacturer may not always be able to use this option since the chassis is sometimes supplied by a customer. If an incomplete vehicle design supplied by a customer is such that the vehicle might not comply with Standard No. 216 if completed outside the limits specified by the manufacturer, NHTSA believes that the final-stage manufacturer must advise the customer that a more suitable chassis is necessary as a matter of law, and desirable as a matter of safety.

NTEA asserted that final-stage manufacturers using incomplete chassis cabs will not be able to pass through the incomplete chassis cab manufacturer's certification for roof crush. According to NTEA, it would not be possible for a stripped chassis manufacturer to provide any parameters for roof completion and certification since no cab or roof would exist. NTEA also asserted that a cutaway chassis, which has a cab and roof but no wall behind the driver compartment, is not likely to come with information concerning the roof crush capabilities of the vehicle.

NHTSA does not believe that this will be a problem for the vehicles covered by the final rule. As shown in the Final Regulatory Evaluation, no incomplete chassis cabs are produced with a GVWR of 6,000 pounds or less.

NHTSA believes that incomplete vehicle manufacturers will continue to provide chassis that can satisfy the market need for vehicles that have reasonable compliance limits and that, in many cases, enable a final-stage manufacturer to adopt either the first or second option discussed above. However, whether or not the complete vehicle manufacturers do so, a final-stage manufacturer has additional options.

The final-stage manufacturer may choose not to remain within the incomplete vehicle manufacturer's limits for the chassis. In such a case, the final-stage manufacturer could not rely on the incomplete vehicle manufacturer's certification and/or limits as the basis for certifying the completed vehicle. Instead, the final-stage manufacturer would have to take steps, such as conducting or sponsoring testing or engineering analysis, sufficient to enable it to certify, with due care, that the completed vehicle complies with applicable safety standards, including Standard No. 216.

Even in this situation, NHTSA does not believe that each final-stage manufacturer would have to conduct its own testing. Commenters pointed out possible alternatives to testing by each final-stage manufacturer. Bay Bridge Manufacturing, Inc. (Bay Bridge) suggested that a group test the type of vehicle that Bay Bridge and its competitors manufacture, with the cost of testing shared by all of the final-stage manufacturers of that type of vehicle. Bay Bridge thought that this would limit the cost of certification to a reasonable amount. Continental Van & Truck Conversions (Continental) suggested that van converters, raised roof manufacturers, and van chassis manufacturers cooperate to design a raised roof and an installation procedure that complies with Standard No. 216. Continental volunteered to help in such an endeavor. NHTSA agrees that approaches such as those suggested by Bay Bridge and Continental could limit the costs of compliance testing. In the Final Regulatory Evaluation, NHTSA further analyzes issues concerning compliance with Standard No. 216 through testing.

In consideration of the foregoing, 49 CFR Part 571 is amended as follows:

1. The title of the heading of Standard No. 216, Roof Crush Resistance—Passenger Cars, is revised to read as follows:

Standard No. 216; Roof Crush Resistance.

2. Paragraph S3 is revised to read as follows:

S3. *Application.* This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less. However, it does not apply to (a) school buses, (b) vehicles that conform to the rollover test requirements (S5.3) of Standard No. 208 (§ 571.208) by means that require no action by vehicle occupants, or (c) convertibles, except for optional compliance with the standard as an alternative to the rollover test requirements in S5.3 of Standard No. 208.

3. Paragraph S4 is revised to read as follows:

S4. *Requirements.*

(a) Passenger cars. A test device as described in S5 shall not move more than 5 inches, measured in accordance with S6.4, when it is used to apply a force of 1½ times the unloaded vehicle weight of the vehicle or 5,000 pounds, whichever is less, to either side of the forward edge of a vehicle's roof in accordance with the procedures of S6. Both the left and right front portions of the vehicle's roof structure shall be capable of meeting the requirements, but a particular vehicle need not meet further requirements after being tested at one location.

(b) Multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less, manufactured on or after September 1, 1993. A test device as described in S5 shall not move more than 5 inches, measured in accordance with S6.4, when it is used to apply a force of 1½ times the unloaded vehicle weight of the vehicle to either side of the forward edge of a vehicle's roof in accordance with the procedures of S6. Both the left and right front portions of the vehicle's roof structure shall be capable of meeting the requirements, but a particular vehicle need not meet further requirements after being tested at one location.

4. Paragraph S6.3 is revised to read as follows:

S6.3 (a) Passenger cars. Apply force in a downward direction perpendicular to the lower surface of the test device at a rate of not more than one-half inch per second until reaching a force of 1½ times the unloaded vehicle weight of the tested vehicle or 5,000 pounds, whichever is less. Complete the test within 120 seconds. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S6.2(a) through S6.2(d).

(b) Multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less, manufactured on or after September 1, 1993. Apply force in a downward direction perpendicular to the lower surface of the test device at a rate of not more than one-half inch per second until reaching a force of 1½ times the unloaded vehicle weight of the tested vehicle. Complete the test within 120 seconds. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S6.2(a) through S6.2(d).

Issued on April 11, 1991.

Jerry Ralph Curry
Administrator

56 F.R. 15510
April 17, 1991

MOTOR VEHICLE SAFETY STANDARD NO. 216

Roof Crush Resistance

S1. Scope. This standard establishes strength requirements for the passenger compartment roof.

S2. Purpose. The purpose of this standard is to reduce deaths and injuries due to the crushing of the roof into the passenger compartment in rollover accidents.

S3. Application. [This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less. However, it does not apply to (a) school buses, (b) vehicles that conform to the rollover test requirements (S5.3) of Standard 208 (§ 571.208) by means that require no action by vehicle occupants, or (c) convertibles, except for optional compliance with the standard as an alternative to the rollover test requirements in S5.3 of Standard 208. **(56 F.R. 15510—April 17, 1991. Effective: September 1, 1993)]**

S4. Requirements.

[(a) *Passenger cars.* A test device as described in S5 shall not move more than 5 inches, measured in accordance with S6.4, when it is used to apply a force of 1½ times the unloaded vehicle weight of the vehicle or 5,000 pounds, whichever is less, to either side of the forward edge of a vehicle's roof in accordance with the procedures of S6. Both the left and right front portions of the vehicle's roof structure shall be capable of meeting the requirements, but a particular vehicle need not meet further requirements after being tested at one location.

(b) *Multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less, manufactured on or after September 1, 1993.* A test device as described in S5 shall not move more than 5 inches, measured in accordance with S6.4, when it is used to apply a force of 1½ times the unloaded vehicle weight of the vehicle to either side of the forward edge of a vehicle's roof in accordance with the procedures of S6. Both the left and right front portions of the vehicle's roof structure shall be capable of meeting the requirements, but a particular vehicle need not meet further requirements after being tested at one location. **(56 F.R. 15510—April 17, 1991. Effective: September 1, 1993)]**

S5. Test Device. The test device is a rigid unyielding block with its lower surface formed as a flat rectangle 30 inches × 72 inches.

S6. Test Procedure. Each vehicle shall be capable of meeting the requirements of S4 when tested in accordance with the following procedure.

S6.1. Place the sills or the chassis frame of the vehicle on a rigid horizontal surface, fix the vehicle rigidly in position, close all windows, close and lock all doors, and secure any convertible top or removable roof structure in place over the passenger compartment.

S6.2 Orient the test device as shown in Figure 1, so that—

(a) Its longitudinal axis is at a forward angle (side view) of 5° below the horizontal, and is parallel to the vertical plane through the vehicle's longitudinal centerline;

(b) Its lateral axis is at a lateral outboard angle, in the front view projection, 25° below the horizontal;

(c) Its lower surface is tangent to the surface of the vehicle; and

(d) The initial contact point, or center of the initial contact area, is on the longitudinal centerline of the lower surface of the test device and 10 inches from the forwardmost point of that centerline.

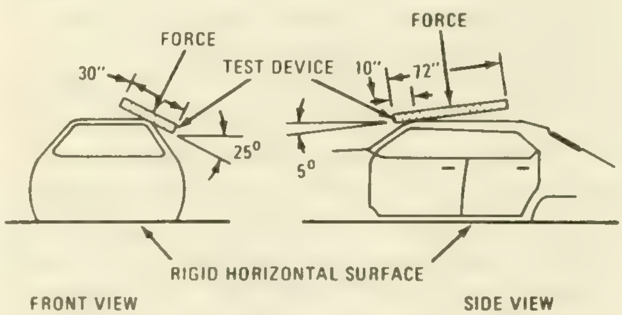


Figure 1

S6.3. [(a) *Passenger cars.* Apply force in a downward direction perpendicular to the lower surface of the test device at a rate of not more than one-half inch per second until reaching a force of 1½ times the unloaded vehicle weight of the tested vehicle or 5,000 pounds, whichever is less. Complete the test within 120 seconds. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S6.2(a) through S6.2(d).

(b) *Multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less, manufactured on or after September 1, 1993.* Apply force in a downward direction perpendicular to the lower surface of the test device at a rate of not more than one-half inch per second until reaching a force of 1½ times the unloaded vehicle weight of the tested vehicle. Complete the test within 120 seconds. Guide the test device so that throughout the test it moves, without rotation, in a straight line with its lower surface oriented as specified in S6.2(a) through S6.2(d). **(56 F.R. 15510—April 17, 1991. Effective: September 1, 1993)]**

S6.4 Measure the distance that the test device moves, *i.e.,* the distance between the original location of the lower surface of the test device and its location as the force level specified in S6.3 is reached.

36 F.R. 23299
December 8, 1971

MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket No. 2–10; Notice 3)

The purpose of this amendment to § 571.21 of Title 49, Code of Federal Regulations, is to add a new motor vehicle safety standard that establishes minimum requirements for bus window retention and release to reduce the likelihood of passenger ejection in accidents and enhance passenger exit in emergencies.

A notice of proposed rulemaking on this subject was published on August 15, 1970 (35 F.R. 13025). The comments received in response to the notice have been considered in this issuance of a final rule.

For reasons of clarification, the requirements paragraph has been reorganized and the demonstration procedures paragraph has been replaced by a test conditions paragraph. Some of the specifications of the demonstration procedures paragraph are incorporated under the requirements paragraph, and the remainder are retained under the test conditions paragraph. With the exception of the changes discussed below, the reorganization does not affect the substance of the standard.

In altering the window retention requirements, the final rule lowers the force application limit, provides more precise glazing breakage and glazing yield limits, and exempts small windows. With respect to the emergency exit requirements, the standard permits devices other than push-out windows to be used for emergency exits, permits buses with a GVWR of 10,000 pounds or less to utilize devices other than emergency exits for emergency egress, and permits an alternate roof exit when the bus configuration precludes provision of a rear emergency exit. It also raises the force limits for release and extension of emergency exits, deletes the inertial load requirement for the release mechanism, and requires that emergency exit location markings be located within each occupant space adjacent to an exit.

A few changes have been made in the diagram accompanying the standard. Figure 1, "Adjacent Designated Seating Position, Occupant Spaces, and Push-Out Window Relationship," has been deleted from the final rule because the relationship is sufficiently described in the text of the standard. Accordingly, Figures 2 and 3 have been renumbered as Figures 1 and 2, respectively. A new Figure 3, indicating access regions for emergency exits which do not have adjacent seats, has been added. For reasons of clarification, Figures 2a and 2b and Figures 3a and 3b in the proposed rule have been placed beside each other to form Figures 1 and 2 respectively.

The torque in Figures 2a and 2b of the proposed rule has been transferred to the text and has been explained to indicate that the force used to obtain the torque shall not be more than 20 pounds. In addition, the clearance specifications in Figures 1 and 2 have been clarified in the text to require that the lower edge of the force envelope shall be located 5 inches above the seat, or 2 inches above the armrest, if any, whichever is higher. In several instances, minor changes have been made in the labeling without altering the substance of the diagrams.

A number of comments sought changes in the window retention requirements. Two comments requested an exemption for intra-city buses because the probability of rollover accidents would be minimal in slow-speed operation. Urban transit buses are subjected to risks of rollover accidents within the city when they travel at moderate to high speed on intra-urban expressways, and should therefore be covered by the

standard. Accordingly, the request for this exemption is denied.

Several comments requested an exemption for small windows. Since there is little likelihood of passenger ejection or protrusion from window openings whose minimum surface dimension measured through the center of the area is less than eight inches, an exemption for windows of this size has been granted.

Two comments asked that the 2,000 pound force application limit in the window retention requirement be lowered. The data indicates that a 1,200-pound limit would be more compatible with the glazing strength. Accordingly, the 2,000-pound force application limit has been lowered to 1,200 pounds.

Several manufacturers stated that they encountered difficulties in ascertaining when the proposed head form penetration limit of the window retention requirement had been reached. After observation of window retention testing, the NHTSA has concluded that the penetration limit as specified in the notice of proposed rulemaking is difficult to determine. For this reason the head form penetration limit has been rephrased in terms of the development of cracks in the glazing and the amount of depression of the glazing surface in relation to its original position.

A number of comments objected to the requirement that at least 75% of the glazing be retained in the window mounting during window retention testing. The NHTSA has determined that the intent of this requirement is already accomplished by the requirement that each window be retained during testing by its surrounding structure in a manner which would prevent passage of a 4-inch sphere, and the requirement is accordingly deleted from the final rule.

With respect to the emergency exit requirements, the standard permits devices other than push-out windows to be used for emergency exits. Upon review of the requirements, it has been determined that devices such as panels and doors which meet the emergency exit requirements would be as effective as push-out windows for emergency egress. Because the Administration has concluded that passenger egress is enhanced when several emergency exits are provided, the standard requires that in computing whether a bus meets the unobstructed openings area requirements, no emergency exit, regardless of its area, shall be credited with more than 520 square inches of the total area requirement.

A number of motor vehicle manufacturers sought exemption from the emergency exit requirements for smaller vehicles weighing 10,000 pounds or less GVWR, such as limousines and station wagons, which are designed to carry more than 10 persons and are therefore considered to be buses under NHTSA regulations (49 CFR 571.3). Such vehicles are usually provided with numerous doors and windows which provide sufficient unobstructed openings for emergency exit. Therefore the Administration has concluded that the configuration of these vehicles satisfies the intent of the standard with respect to provision of emergency exits, and they are exempted from the emergency exit openings requirements.

The emergency exit requirements have been changed to permit installation of an alternate roof exit when the bus configuration precludes provision of a rear exit, provided that the roof exit meets the release, extension, and identification requirements. The NHTSA has established this alternative in order to allow design flexibility while providing for emergency egress in rollover situations.

A number of comments expressed concern that the proposed maximum force level for release and extension of emergency exits in Figures 2a and b and 3a and b were too low to inhibit inadvertent operation by passengers and suggested that the required maximum force level be raised. After consideration of the goals of facilitating emergency egress and preserving the integrity of the passenger compartment under normal operation, it has been determined that the maximum force levels should be raised from 10 and 30 pounds to 20 and 60 pounds respectively.

One comment submitted the results of testing which indicated that the 30g inertial load requirement for the release mechanism was unnecessarily high. The testing also revealed that the engineering concepts upon which the inertial load requirement is based are not generally applied in the industry and that the requirement

would be impracticable. Moreover, an increase in maximum force levels for emergency exit operation in the rule should improve latch integrity. For these reasons, the requirement has been deleted.

The standard requires emergency exit location markings to be placed in certain occupant spaces because of a possible contradiction under the proposed standard between the requirement that the identification markings be located within 6 inches of the point of operation and the requirement that the markings be visible to a seated occupant. The NHTSA has concluded that emergency egress could be hindered if the passenger has difficulty in finding the marking, and that location of the marking outside of an occupant space containing an adjacent seat, which would be permitted under the proposed standard, could create this problem. At the same time it is desirable for the identification and instructions to be located near the point of release. Therefore the final rule requires that when a release mechanism is not located within an occupant space containing an adjacent seat, a label indicating the location of the nearest release mechanism shall be placed within that occupant space.

The temperature condition has been reworded to make it clear, in light of the explanation of usage in § 571.4, that the vehicle must be capable of meeting the performance requirements at any temperature from 70° F. to 85° F.

Effective date: September 1, 1973. After evaluation of the comments and other information, it has been determined that the structural changes required by the standard will be such that many manufacturers will require an effective date of at least fifteen months after issuance. It is therefore found, for good cause shown, that an effective date more than one year from the date of issuance is in the public interest.

In consideration of the above, Standard No. 217, Bus Window Retention and Release, is added to § 571.21 of Title 49, Code of Federal Regulations, as set forth below.

This rule is issued under the authority of sections 103, 112, and 119 of the National Traffic and Motor Vehicle Safety Act, 15 U.S.C. 1392, 1401, 1407, and the delegation of authority at 49 CFR 1.51.

Issued on May 3, 1972.

Douglas W. Toms
Administrator

37 F.R. 9394
May 10, 1972

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket 2–10; Notice 4)

The purpose of this notice is to respond to petitions for reconsideration of Motor Vehicle Safety Standard No. 217, Bus Window Retention and Release, in § 571.217 of Title 49, Code of Federal Regulations. The standard was issued on May 10, 1972 (37 F.R. 9394).

International Harvester stated that it manufactures an 18-passenger airport limousine, the "Stageway Coach Conversion", weighing 10,700 pounds GVWR and requested that it be exempted from the requirements of S5.2.1, "Buses with GVWR of more than 10,000 pounds." They emphasized that the 18-passenger model is equipped with 10 side doors, two more than is provided by a 15-passenger, 10,000-pound, version of a similar airport limousine vehicle which they manufacture. The NHTSA has concluded that vehicles which provide at least one door for each three passenger seating positions afford sufficient means of emergency egress regardless of their weight. S5.2.1 has accordingly been amended to provide that buses with a GVWR of more than 10,000 pounds may alternatively meet the unobstructed openings requirement of S5.2 by providing at least one door for each three passenger spaces in the vehicle. The "Stageway Coach Conversion" falls into the category of vehicles covered by this amendment and thus International Harvester's request is granted.

International Harvester, General Motors, and Chrysler all requested a clarification of the S5.1 window retention requirements because they felt it was possible to interpret the paragraph as prohibiting the use of tempered glass for window glazing. Ford also submitted a request for exemption from the window retention requirements for buses under 10,000 pounds GVWR based on its interpretation of S5.1 as precluding the use of tempered glass. The petitioners stated that tempered glass would shatter under the application of pressure required, and were not certain whether S5.1(b), describing the development of cracks in the glazing, would cover this occurence. The NHTSA did not intend to prohibit the use of tempered glass, and in order to correct this possible ambiguity, S5.1(b) has been amended to include shattering of the window glazing.

General Motors also requested an interpretation of the method of measuring whether 80 percent of the glazing thickness has developed cracks as described in S5.1(b). The paragraph refers to a measurement through the thickness of glass and not a measurement of the glazing surface area, as GM suggests it could mean. GM also doubted that the percentage of glazing thickness which develops cracks could be measured. The NHTSA has determined that the intent of the language is clear and that performance of this measurement is within the state of the art, so that no change in the language is necessary. The request is therefore denied.

General Motors requested a clarification of the term "minimum surface dimension" in paragraph S5.1(c). The NHTSA agrees that a clarification is necessary to prevent interpretations which may not meet the intent of this standard, and the paragraph has been accordingly amended to specify that the dimension is to be measured through the center of the area of the sheet of glazing.

General Motors stated that it interpreted the head form travel rate specified in S5.1.1 of two inches per minute as a "nominal value" requirement, since no tolerances are given in the standard. The test conditions in a safety standard

represent the performance levels that the product must be *capable* of meeting. They are not instructions either to the manufacturers' or the government's test laboratories, or a requirement that the product should be tested at "exactly" those levels. The manufacturers' tests in this case should be designed to demonstrate that the vehicle would meet the stated requirements *if* tested at two inches per minute. If that is what General Motors means by a "nominal value", its interpretation is correct.

In consideration of the foregoing, Motor Vehicle Safety Standard No. 217, Bus Window Retention and Release, 49 CFR 571.217, is amended....

Effective date: September 1, 1973.

This notice is issued under the authority of sections 103, 112, and 119 of the National Traffic and Motor Vehicle Safety Act, 15 U.S.C. 1392, 1401, 1407, and the delegation of authority at 49 CFR 1.51.

Issued on August 30, 1972.

Douglas W. Toms
Administrator

37 F.R. 18034
September 6, 1972

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket No. 2–10; Notice 5)

The purpose of this notice is to amend Motor Vehicle Safety Standard No. 217, Bus Window Retention and Release, 49 CFR § 571.217, in response to petitions received. Several minor amendments for purposes of clarification have also been made. The standard was published initially on May 10, 1972, (37 F.R. 9394), and amended September 6, 1972 (37 F.R. 18034).

Wayne Corporation has petitioned that the torque limit of 20 inch-pounds for the actuation of rotary emergency exit releases in S5.3.2(a)(3) of the standard is impractical. The Blue Bird Body Company also objected to the requirement, requesting that the limit be raised to 225 inch-pounds in order to avoid inadvertent openings. The NHTSA has decided, based on these petitions, that a maximum torque requirement is redudant, since the force magnitude generally is limited in S5.3.2 to not more than twenty pounds. Accordingly the torque requirement is deleted from the rule.

Blue Bird also requested that Figure 3A, which depicts access region for roof and side emergency exits without adjacent seats in both an upright and overturned bus, be made more explicit.

In response to this request, Figure 3A is being replaced by two figures, one of which depicts a side emergency exit (Figure 3A), and the other a roof emergency exit (Figure 3B). Existing Figure 3B, depicting access regions for a rear exit with a rear shelf or other obstruction behind the rearmost seat, becomes Figure 3C. A new Figure 3D is added to depict rear seat access regions in buses not having a rear shelf or other obstruction behind the rearmost seat, a configuration common to school buses. Paragraph S5.2.1, regarding provision of emergency exits, is amended to make it clear that a required rear exit must meet the requirements of S5.3 through S5.5 when the bust is overturned on either side, with the occupant standing facing the exit, as well as when the bus is upright.

In consideration of the above, Standard No. 217, Bus Window Retention and Release, 49 CFR 571.217, is amended . . . .

Effective date: September 1, 1973.

(Sec. 103, 112, 119, P.L. 89–563, 80 Stat. 718, 15 U.S.C. 1392, 1401, 1407) and the delegation of authority at 49 CFR 1.51.

Issued on February 28, 1973.

Douglas W. Toms
Administrator

38 F.R. 6070
March 6, 1973

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket No. 2–10; Notice 7)

This notice amends Federal Motor Vehicle Safety Standard No. 217, "Bus Window Retention and Release" (49 CFR § 571.217), to exempt from the standard buses manufactured for the purpose of transporting persons under physical restraint. The amendment is based on a notice of proposed rulemaking published October 1, 1973 (38 F.R. 27227), following petitions received from the Bureau of Prisons, United States Department of Justice.

The comments received in response to the proposal agreed that buses manufactured for the specified purpose should not be provided with the emergency exits required by Standard No. 217. The standard specifies that buses contain emergency exits operable by bus occupants, requirements which the NHTSA considers obviously incompatible with the need to transport prison inmates. The National Transportation Safety Board (NTSB) commented, however, that compensatory measures should be taken to minimize the likelihood of fire in prison buses, since the probability of safely evacuating a prison bus is less than that of any other type of bus. The NTSB urged that the exemption be limited to diesel-fueled buses, since diesel fuel is less likely to ignite than gasoline.

The NHTSA recognizes the desirability of minimizing the likelihood of fire in buses. However, at the present time it is not practical to expect that all newly manufactured prison buses be equipped with diesel engines, given the apparent immediate need for the exemption. Appropriate rulemaking action can be taken in the future if it appears necessary to mitigate from a safety standpoint the loss of emergency exits in prison buses.

In light of the above, paragraph S3 of section 571.217, Title 49, Code of Federal Regulations (Motor Vehicle Safety Standard No. 217), is amended. . . .

Effective date: June 3, 1974. This amendment imposes no additional burdens on any person and relieves restrictions found to be unwarranted. Accordingly, good cause exists and is hereby found for an effective date less than 180 days from the day of issuance.

(Secs. 103, 112, and 119, Pub. L. 89–563; 80 Stat. 718; 15 U.S.C. 1392, 1491, 1407; delegations of authority at 49 CFR 1.51.)

Issued on April 26, 1974.

James B. Gregory
Administrator

39 F.R. 15274
May 2, 1974

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket No. 75–6; Notice 2)

This notice amends Federal Motor Vehicle Safety Standard No. 217, *Bus Window Retention and Release*, 49 CFR 571.217, to clarify the marking requirements for emergency exits on buses. The amendment requires certain markings on all bus emergency exits except manually-operated windows of sufficient size and doors in buses with a GVWR of 10,000 pounds or less.

The amendment was proposed in a notice published April 18, 1975 (40 FR 17266). Comments were received from Chrysler Corporation and General Motors. Chrysler concurred with the proposal. GM, while also concurring, suggested that the wording of the amendment be modified somewhat. The amendment has been reworded to reflect more clearly the intent of this amendment, distinguishing between emergency exits that require markings and those that do not. The NHTSA has determined that special emergency exit markings are unnecessary for doors and manually-operated windows in buses with a GVWR of 10,000 pounds or less. This amendment does not exempt buses with a GVWR of 10,000 pounds or less from complying with the unobstructed openings requirements of S5.2. It only provides that the openings do not have to be marked as emergency exits. However, specially-installed emergency exits in such buses, such as push-out windows, are not exempted from the marking requirements.

The amendment also allows bus manufacturers the option of designating an emergency door as "Emergency Door" or "Emergency Exit." This will bring Standard No. 217 into conformity with current NHTSA interpretations of the emergency exit marking requirements. However, any emergency exit other than a door must have the designation "Emergency Exit."

Accordingly, S5.5.1 of 49 CFR 571.217, *Bus Window Retention and Release*, is amended . . . .

Effective date: October 16, 1975.

(Secs. 103, 112, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1401, 1407); delegations of authority at 49 CFR 1.51).

Issued on October 8, 1975.

Gene G. Mannella
Acting Administrator

40 F.R. 48512
October 16, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket NO. 75–3; Notice 2)

This notice amends Federal Motor Vehicle Safety Standard No. 217, *Bus Window Retention and Release*, 49 CFR 571.217, to specify requirements for emergency doors for school buses pursuant to the provisions of section 202 of the Motor Vehicle and Schoolbus Safety Amendments of 1974 (Public Law 93–492, 88 Stat. 1484, 15 U.S.C. 1392). It responds to the congressional mandate to establish standards concerning school bus emergency exits (15 U.S.C. § 1392(i) (1) (A) (i)).

Section 202 requires that certain school bus safety standards be published within 15 months of the passage of the 1974 amendments on October 27, 1974. In addition, these statutory provisions remove the otherwise discretionary authority of the NHTSA to establish lead times for compliance under the general rulemaking provisions of the National Traffic and Motor Vehicle Safety Act by specifying an effective date for the amendment of 9 months from the date of publication of this notice (15 U.S.C. § 1392(i) (1) (B)). The proposed amendments upon which this notice is based were published on February 28, 1975 (40 F.R. 8569).

Many comments were received in response to the proposal to require either one rear emergency door or two side emergency doors in the rear half of the bus passenger compartment. Many objected that the proposal provided for too few emergency doors, and requested requirements for additional side doors and roof exits. Some commenters suggested that push-out windows and the "California" rear exit be required. The agency does not discourage the inclusion of additional emergency exits in school buses so long as they comply with the requirements applicable to non-school bus emergency exits. The NHTSA believes that "California" rear window emergency exits may be preferable in certain circumstances and proposes in this issue of the Federal Register to amend this rule to permit the use of the "California" rear window along with a side door emergency exit in place of the rear door emergency exit. In the alternative, it is proposed to allow this option only on rear-engine-powered school buses. Under either proposal the requirements of the standard would not be met by providing two sidedoor emergency exits. In addition, the subject of roof exits is being considered and could be the subject of future rulemaking. However, roof exit requirements cannot be included in this rulemaking action because of the statutorily imposed deadline on promulgation of these amendments.

A number of comments were received opposing the proposed interlock requirement on the ground that it would prevent restarting the engine after the school bus stalls in a dangerous intersection or a railroad crossing and panicky passengers jam the release mechinism. The intent of this requirement is to prevent the initial starting of the bus engine until the doors have been unlocked, by a key, combination, or the operation of a remote switch at the beginning of the day. The deletion of the phrase "or otherwise inoperable" excludes inadvertent jamming of the door release mechanism from the requirement. The word "locked" has been defined for this purpose as not releasable at the door except by a key or combination. It would include doors openable by a remote switch.

Six comments supported the proposal to reqiure an audible alarm when the ignition is on and the release mechanism of any emergency door is not closed. Five of these, however, objected that an alarm at each door in addition to one in the driver's compartment would be unnecessary and unduly costly. The NHTSA does not agree. The purpose of audible alarms at each door is to indicate which release mechanism is not closed. This is especially critical while the vehicle is in motion, as it will serve to warn the passengers in the area of the possibility that an emergency door could open. In addition, it will serve as a deterrent to tampering by children with the emergency door release mechanisms. Therefore, the requirement that an audible alarm be positioned at each emergency door and at the driver's position has been retained.

Objectives were received to the requirement that the magnitude of force required to activate the emergency door release mechanism be not more than 40 pounds. The NHTSA does not consider that the 40 pound force limit is too high in light of the location and access requirements of this standard. If the maximum force level were substantially lowered, there would be a significant likelihood that emergency door release mechanisms would be inadvertently activated by a passenger.

In addition, the NHTSA has noted the possibility of ambiguity with respect to the wording of paragraph S5.4 of the old standard and S5.4.2 of the proposal. The intent of these paragraphs is to specify conditions applicable to the opening of the exit *after* the release mechanism has been activated. Accordingly, the wording of the two paragraphs has been modified to clearly reflect this intent.

Many school districts and manufacturers objected to the parallelepiped clearance requirement for the emergency doors because of the number of seats that would be eliminated and the costs of redesigning van-type school buses to meet the clearance requirements. In addition, many commenters pointed out that the 12-inch aisle in most school buses precludes effective use of a large exit meeting the proposed requirements.

The NHTSA has determined that these arguments have merit. As a result, the proposed paralellepiped requirements have been modified by reducing the height from 48 inches to 45 inches, reducing the depth from 24 to 12 inches for rear exits in buses over 10,000 lbs GVWR, and to 6 inches for rear exits in buses under 10,000 lbs GVWR. For side exits the depth has been eliminated altogether. Additionally, the forward edge of the side door now coincides with a vertical transverse plane tangent to the rearmost point of the adjacent seat, thus permitting simultaneous exiting of two occupants, between the seat backs and over the seat cushion.

In light of the above, 49 CFR § 571.217, *Bus Window Retention and Release*, is amended . . . .

Effective date: October 26, 1976.

(Secs. 103, 112, 119, Pub. L. 89-563, 80 Stat. 718; Sec. 202, Pub. L. 93-492, 88 Stat. 1484 (15 U.S.C. 1392, 1401, 1407); delegation of authority at 49 CFR 1.50.)

Issued on January 22, 1976.

Howard J. Dugoff
Acting Administrator

41 F.R. 3871
January 27, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release

(Docket No. 75-3; Notice 4)

This notice amends Standard No. 217, *Bus Window Retention and Release*, to modify the emergency exit requirements of the standard in response to a petition for reconsideration of recent amendments and after consideration of comments on the agency's proposal to specify new performance options and labeling for emergency exits.

PETITION FOR RECONSIDERATION OF NOTICE 2

The National Highway Traffic Safety Administration (NHTSA) recently amended Standard No. 217 (49 CFR 571.217) to provide emergency exit requirements for school buses (41 FR 3871, January 27, 1976 (Notice 2)). Section S5.2.3.1 of the standard (as it becomes effective for school buses on October 26, 1976) specifies that a rear emergency door shall be hinged on the right side. Chrysler Corporation has petitioned for reconsideration of this provision, asking that a manufacturer option be provided so that the rear emergency door or doors on van-type school buses may be hinged on the right or left.

The purpose of specifying that the rear emergency door hinge to the right is based on the NHTSA finding that school buses often operate on rural highways that are bordered by drainage ditches, and that a school bus that leaves the highway and rolls over is likely to come to rest in the right-hand ditch on its right side. When a bus comes to a rest on its side, the emergency door on the rear of the bus is easier to operate, particularly by small children, if it is hinged so that its operation is assisted by gravity.

Chrysler pointed out that the rear emergency door on van-type school buses is often used routinely for loading and unloading passengers. For this reason, Chrysler offers a single rear door that hinges at the left side, so that the door swings out of the way to safely accommodate curb-side loading. In the case of larger buses, routine loading and unloading does not occur through the rear emergency door.

The NHTSA agrees with Chrysler that the common practice of curb-side loading through the rear door of van-type school buses justifies a manufacturer option in selecting the side of the door which should be hinged. On balance, the agency considers that the increase in safety for routine curb-side loading through a left-hinged door would outweight any potential loss of safety benefit for emergency evacuation from a van-type bus that comes to rest on its right side. Accordingly, S5.2.3.1 of the standard is appropriately amended. The agency also takes the opportunity to correct an inadvertent reference to emergency "exit" in S5.2.3.2 when the requirements are actually intended to apply only to an emergency "door."

In a matter unrelated to the Chrysler petition, some uncertainty has arisen over the form of S5.4 as it was revised in Notice 2 to become effective October 26, 1976. Also, the division between buses with a GVWR of 10,000 pounds or less and those with a greater GVWR was imperfectly stated in amending S5.4. For this reason, the amendment of S5.4 is republished in the correct form in this notice. No substantive changes are made in this republication of S5.4.

EMERGENCY EXIT AND LABELING PROPOSAL—NOTICE 3

At the time the amendments just discussed were published, the NHTSA published a proposal to clarify certain emergency exit labeling for all buses, and to replace the established option for school bus emergency exits with a new

option (41 FR 3878, January 27, 1976; Notice 3). Comments were received from the Lanai Road Elementary School Parent-Teachers Association, Gillig Brothers (Gillig), Chrysler Corporation, Mr. Allen Braslow, Crown Coach Corporation (Crown), and International Harvester (IH). No comment was received from manufacturers of transit or intercity buses, or from the manufacturers of body-on-chassis school buses. The National Motor Vehicle Safety Council did not comment on this proposal.

With regard to emergency exit labeling, Mr. Braslow suggested two labeling changes intended to assist bus occupants, as well as a requirement for regular testing of emergency exits in buses in highway service. While the latter suggestion lies beyond the authority of the agency under the National Traffic and Motor Vehicle Safety Act (15 U.S.C. § 1391, et seq.), the agency will consider for future action the suggestion to label all bus exits in the same manner as school bus exits, as well as the suggestion to develop a universal emergency exit insignia with diagramatic instructions. For the moment, the agency is limited by the extent of its proposal, and accordingly, makes final the changes as proposed.

Standard No. 217 requires (effective October 26, 1976) school buses to provide either a rear emergency door or two side emergency doors in satisfaction of the emergency exit requirements. In Notice 3, the agency proposed to modify this option to require either provision of a rear emergency door or, at the option of the manufacturer, provision of a left-side emergency door and a "California rear window" exit at the rear of the bus. This type of rear window exit provides a large (16 by 48 inch) opening which is more easily utilized than a side emergency door if a bus has rolled onto its side. In the alternative, the agency proposed that the option to use a rear window exit only be allowed in rear-engine buses.

The two manufacturers of transit-type school buses supported the new option, but objected to the alternative proposal that would limit use of the option to rear-engine buses. Both Gillig and Crown build mid-engine school buses with essentially the same configuration as rear-engine buses and consider the rear window exit equally useful in these buses. The agency has considered the mid-engine design and agrees with the argument made by Crown and Gillig. Accordingly, the agency amends the standard as proposed to apply the option to all school buses. Crown Coach pointed out that the NHTSA proposal to limit rear-window-exit release mechanisms to a single release would necessitate a change in existing hardware. The NHTSA has investigated the available hardware (consisting in all cases of two release mechanisms that are located within 36 inches of each other) and concludes that the only significant safety hazard in some of the designs is that some require simultaneous operation for release. For this reason, the agency will allow not more than two release mechanisms, provided that the two mechanisms do not have to operate simultaneously to effect release. If new designs present a problem of any nature, further rulemaking will be undertaken.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 FR 16201, April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this proposal on the public and private sectors, including possible loss of safety benefits. The option to hinge some rear emergency doors on the right or left, and the option to use a "California rear window" do not involve additional expenditures. The agency estimates that these additional exit arrangements will not significantly reduce the level of safety provided in the affected bus categories. The new requirements for more specific operating instructions for school bus emergency exits are calculated to involve annual costs of about $67,000. Although the agency is unable to quantify the benefit of clearer exit labeling, it is estimated that better instructions will serve to reduce the possibility of death and injury involved in an attempt to use the emergency exits. Therefore, the agency concludes that the amendments should issue as set forth in this notice.

For the benefit of interested persons, it is noted that Docket 75-6 concerning labeling of bus emergency exits is related to this rulemaking.

In consideration of the foregoing, Standard No. 217 (49 CFR 571.217) as it is amended to become effective for school buses on October 26, 1976, is revised. . . .

Effective date: October 26, 1976. The effective date of the amendments numbered 1, 2, 3 and 5 is established as 9 months after the date of issuance of the amendments on which they are based, as required by the Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492, section 202 (15 U.S.C. 1397(i)(1)(A)). The effective date of the amendment numbered 4 is also established as October 26, 1976, although a manufacturer can meet the requirements at an earlier date if the manufacturer so chooses.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 202, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50.)

Issued on May 25, 1976.

James B. Gregory
Administrator

41 F.R. 22356
June 3, 1976

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Window Retention and Release
(Docket No. 75-03; Notice 7)

ACTION: Final rule.

SUMMARY: This notice makes permanent an interim final rule that modified the agency's school bus emergency exit standard. The interim final rule, which was issued in February 1979, was implemented immediately to increase the availability of passenger vans for use as small school buses at reasonable costs. The interim rule slightly altered several emergency exit requirements in a manner that made it easier to mass produce small buses without significantly affecting the level of safety achieved by those vehicles. Concurrent with the issuance of the interim final rule, the agency solicited comments on the amendments to the standard. This notice responds to the comments and makes the interim rule permanent.

EFFECTIVE DATE: Since this notice makes permanent an existing interim final rule, it is effective immediately.

SUPPLEMENTARY INFORMATION: On February 8, 1979, the agency published an interim final rule and a proposal (44 F.R. 7961) to modify the school bus emergency exit safety standard, Standard No. 217, *Bus Window Retention and Release.* In that notice, the agency made effective immediately some modifications to the school bus emergency exit standard to increase the supply of reasonably priced vehicles suitable for school bus conversion. Among the changes implemented by the interim final rule were a slight decrease in the size of rear emergency exits for vehicles (typically passenger vans) with gross vehicle weight ratings (GVWR) less than 10,000 pounds, and increased flexibility in the location requirements for release mechanisms on the emergency exits of small school buses. The agency concluded at the time the interim rule was issued that the level of safety achieved by small buses would not be diminished by these changes and that the changes would allow more small buses to be mass produced, thereby lowering their prices. The agency also asked in the interim final rule for comments on the advisability of these changes.

In response to the agency's request, Ford, Chrysler, the Center for Auto Safety, and the California Highway Patrol (CHP) submitted comments. The two manufacturers, Ford and Chrysler, both supported the agency's action. The Center and the CHP both opposed the action.

The Center and the CHP both argued that the rear emergency exit in small school buses (passenger vans which have GVWR's less than 10,000 pounds and are used as school buses) should not be reduced in size. The Center stated that the exit should be broad enough for two students to exit simultaneously in case of an emergency. The CHP stressed that reducing the size of the exit would make it too small to permit the exiting of children in wheelchairs.

With respect to the argument that the size of the rear exit should allow room to exit students two abreast, the agency stated in the proposal that this argument, while valid for larger school buses, is not meritorious for school vehicles with GVWR's less than 10,000 pounds. Larger school buses frequently transport 60 or more school children. Accordingly, rapid evacuation of those vehicles in an emergency requires that the students be able to exit two abreast. In order to accomplish this, the agency has required that some space be provided behind the rearmost seat in these buses so that students exiting through the narrow center aisles will have room at the exits to get out two abreast.

In small school buses where the number of students carried frequently is 16 or less, the need for exiting two abreast to achieve rapid evacuation is significantly reduced. In recognition of this factor, the agency has never required bus manufacturers to provide space behind the rear seat of small buses that would allow students to exit two abreast. As a result, the rear seats of small buses are frequently quite near or are against the rear bus wall. Students exiting down a bus aisle, which is normally around 12 inches in width, reach an exit where no space is provided to exit two abreast. Accordingly, any requirement that an exit in small buses be large enough to facilitate exiting two abreast would not accomplish that goal. Small bus manufacturers would need to redesign their bus seat plans in some fashion to provide space behind the rear seat in order to allow exiting two abreast. Such a redesign would significantly decrease the available seating in small buses. Given the fact that evacuating small buses has not been a safety problem, the agency concludes that the cost resulting from the reduced vehicle seating that would be required to accomplish the Center's objectives would far outweigh the benefits. Accordingly, the agency concludes that a broader rear exit is not needed in small school buses.

The CHP objected to the same requirement stating that the new exit door would be too narrow for wheelchairs. The CHP further stated that California has always required wider exits so that wheelchairs can be used in the vehicles.

The agency's new exit requirement is a minimum size requirement for standard school buses. In special instances in which larger exits are desired, such as in buses for carrying the handicapped, the States may require that their buses have such exits. The agency deems that approach to be preferable to its requiring larger exits in all vehicles. The situation with respect to rear door size is analogous to that involving seat back height. The agency requires a minimum seat back height. New York mandates a seat back height greater than the Federal specification. The NHTSA has no objection to the New York requirement and will not object to requirements by other States for wider rear emergency exits. The agency also notes that buses designed for the handicapped constitute a small portion of all buses and usually are equipped with special doors and larger aisles.

The Center also objected to the agency's interpretation that the parallelipiped device used for measuring rear door size could be lifted up to 1-inch to overcome small protrusions near the floor. The agency issued an interpretation permitting this at the time of the implementation of the standard. This interpretation simply reflects real-world conditions. Many doors in vehicles have small door sills or other minor protrusions that sometimes serve necessary functions in the proper operation of the door. These minor protrusions play no significant role in the ability of students to exit from a vehicle in an emergency. Therefore, the agency will not reconsider its interpretation.

The Center objected to the agency's removal of exit release mechanism location and force application requirements for small school buses. The Center agreed that the existing requirements are more appropriate for larger buses, but it insisted that the agency should develop another set of location requirements for smaller buses instead of abandoning the requirements entirely.

The agency is sympathetic to the Center's concerns about this issue. The location of the release mechanism for small school buses in an easily accessible location is important for the rapid evacuation of these vehicles in an emergency. However, the mere setting of location requirements would not ensure that the release mechanisms would be accessible. Due to the limited space in the rear of small buses and the variability of design in those areas, the agency could not readily specify a location which would provide the necessary accessibility. The agency believes that allowing manufacturers the option of locating the release mechanism in any easily accessible location on or near the exit will be more beneficial to achieving the intended safety results than any rigid inflexible location requirement. NHTSA anticipates that product liability concerns and the agency's authority to declare inaccessible release mechanisms to be safety-related defects will suffice to induce the manufacturers to select accessible locations. The agency will closely monitor the location and accessibility of the release mechanisms and, if necessary, use both its defects and rulemaking authority to take corrective action.

Finally, the Center objected to the fact that the agency permitted pull-type release mechanisms.

The Center stated that release mechanism standardization is helpful in assuring the safe evacuation of vehicles.

While the agency agrees that standardization has value in this instance, there are competing ways for achieving standardization in the case of small school buses. One way is to require that small school buses have releases that operate with an upward motion as in larger school buses. Another way is to permit small school buses (which, as noted before, are passenger vans) to have the same pull-type releases that are found in other vans and some cars. The agency doesn't believe that either basis for standardization is clearly superior from a safety standpoint to the other. Further, permitting the use of the pull-type releases will enable the manufacturers to achieve cost savings. Accordingly, the agency declines to adopt the Center's recommendation.

Since this notice makes permanent an existing amendment, it is effective immediately. The agency has reviewed the amendment in accordance with E.O. 12291 and concludes that the rule is not significant under the Department of Transportation's regulatory procedures. In fact, by permitting these changes, more buses can be mass produced, which may result in a small decrease in the cost of complying with the standard. Since the economic impact of this rule is minimal, a regulatory evaluation is not required for this amendment.

The agency has also considered the effect of this rule in relation to the Regulatory Flexibility Act and certifies that it would not have a significant economic impact on a substantial number of small entities. The only economic impact might be a reduction in bus prices. There would similarly be no significant impact on a substantial number of small government jurisdictions and small organizations.

Finally the agency has analyzed this rule for purposes of the National Environmental Policy Act and has determined that it would have no significant impact on the human environment.

Issued on February 10, 1982.

Diane K. Steed
Acting Administrator

47 F.R. 7255
February 18, 1982

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 217
Bus Window Retention and Release

(Docket No. 88–21; Notice 3)
RIN 2127–AC88

ACTION: Final rule.

SUMMARY: This rule amends Federal Motor Vehicle Safety Standard No. 217, *Bus Window Retention and Release*, by revising the minimum requirements for school bus emergency exits and improving access to school bus emergency doors. Instead of requiring all school buses to have the same number of exits, as the standard currently does, this rule sets requirements for minimum emergency exit space based upon the seating capacity of each bus. Thus, larger school buses are required to have an increased number of exits. This rule also requires school buses to provide improved access to side emergency doors. In addition, this rule includes requirements to improve the visibility of school bus emergency exits. This rule is intended to facilitate the exiting of occupants from a bus after an accident and thus improve the likelihood of their survival.

EFFECTIVE DATE: This rule is effective May 2, 1994.

SUPPLEMENTARY INFORMATION:

Background

School buses are an extremely safe means of transportation. The most recent available information (i.e., data for the 1989–90 school year) indicates that approximately 370,000 public school buses traveled over 3.5 billion miles to transport over 22 million children to public schools. In its May 1989 report, "Improving School Bus Safety," the National Academy of Sciences estimated that another 20,000 school buses traveled 0.5 billion miles to transport 3 million school children to private schools. The safety record of school buses in protecting school bus occupants while traveling these billions of miles is impressive. On a vehicle-mile basis, school buses are about four times safer than passenger cars. Despite this outstanding safety record, school bus crashes do occur and occasionally serious injuries and fatalities result.

An important factor in minimizing post-crash injuries and deaths on buses is the speed and ease with which occupants can evacuate the vehicle in an emergency. When Standard No. 217, *Bus Window Retention and Release,* originally became effective on September 1, 1973, it required that buses other than school buses have exits whose combined area, in square inches, equaled or exceeded 67 times the number of designated seating positions. The type of exit used to comply with this requirement was left to the choice of the manufacturer, although the agency assumed that most manufacturers would meet the standard primarily by installing push-out side windows.

School buses were excluded from this requirement for the reasons explained in the notice of proposed rulemaking [NPRM]:

> In view of discipline problems associated with mandatory quick-release and exit devices throughout a school bus which may interfere with the school bus driver's task, and the added risk of children falling from moving school buses, push-out windows for school buses would remain optional. 35 FR 13025; August 15, 1970.

The Standard did require that when a school bus was voluntarily equipped with push-out windows or with other emergency exits, those exits must conform to the same requirements specified in the Standard for exits in buses other than school buses.

In response to the Motor Vehicle and Schoolbus Safety Amendments of 1974 (Pub. L. 93–492), Standard No. 217 was amended to include emergency exit requirements for school buses. Instead of simply specifying that the total combined area, in square inches, of all the exits had to equal or exceed 67 times the number of des-

ignated seating positions, and leaving the choice of exit type to the manufacturer, the agency required (and continues to require) that all new school buses have either (1) one rear emergency door, or (2) "one emergency door on the vehicle's left side that is in the rear half of the bus passenger compartment and is hinged on its forward side, and one push-out rear window." Like all of the agency's safety standards for motor vehicles, Standard No. 217 is a minimum safety standard, in this instance specifying the fewest permissible number of emergency exits for a school bus.

In May 1988, 27 persons died of smoke inhalation in the fire resulting from the high-speed crash of a pick-up truck (driven by a drunk driver) and a used school bus in Carrollton, Kentucky. Several factors were involved in this tragic event, which represented the first fire-related occupant deaths on a school bus-type vehicle since NHTSA began compiling statistics on traffic fatalities in 1975. Some observers suggested that more occupants might have survived the fire if the bus had been equipped with additional (or more accessible) emergency exits. That bus had been manufactured in March 1977, shortly before the new NHTSA school bus safety standards took effect, including upgraded requirements for Standard No. 217. This crash focused considerable public interest on several school bus safety issues, including emergency exits, as well as on the continuing problem of drunk driving. More recently, attention was again focused on school bus exits by the September 1989 crash in Alton, Texas, in which a tractor semi-trailer struck a school bus, which then rolled into a water-filled gravel pit. Twenty-one students drowned as a result of this crash.

Following the Carrollton crash, NHTSA undertook a comprehensive review of its vehicle standards and other programs for school bus safety, and published a summary report in November 1988. That report noted the excellent overall safety record of school buses, but also highlighted areas where further improvements might be made. The National Academy of Sciences [NAS] reached similar conclusions in its report on school bus safety, issued in May 1989.

In November 1988, NHTSA issued an advanced notice of proposed rulemaking [ANPRM] on whether to upgrade Standard No. 217 to specifically enhance the requirements for school bus emergency exits (53 FR 44627; November 4, 1988). The notice explored whether rulemaking to require additional emergency exits was warranted. It posed a series of 24 questions divided into six categories: safety need, requirements for additional exits, the effect of additional exits on other aspects of safety, cost of additional exits, encouraging the correct use of emergency exits, and other factors incident to requiring more emergency exits. NHTSA received 49 comments in response to the ANPRM. The commenters included Federal, State and local government agencies, local school districts, pupil transportation services and associations, bus and equipment manufacturers, and the general public.

After considering the responses to the November 1988 ANPRM, NHTSA issued an NPRM proposing to amend Standard No. 217 to require that the minimum emergency exit space on school buses be based upon the seating capacity of the school bus so that emergency exit capability would be proportional to the maximum occupant capacity of the school bus and the school bus emergency exits requirements would be comparable to the requirements for non-school buses (56 FR 11153; March 15, 1991). The NPRM proposed two options for how the additional emergency exit space required by the proposed formula would be provided. That notice described the options as follows:

> Option A would provide that all additional exits required under the proposal be side exit doors. * * * Option B would require likewise, that where one additional exit is required, it must be a side exit emergency door, but that where the additional exit space required exceeds the area created by that door (1080 square inches), the next 540 square inches of exit space must be provided by a roof exit, and the next 540 square inches provided by a second roof exit. The maximum credit for one roof exit would be 540 square inches, regardless of its actual size. If additional exit space beyond that provided by the side exit door and two roof exits is required (i.e., more than 2160 square inches of additional exit space is required), the proposal would require a second additional side exit emergency door. * * *

The location for emergency exits under each option was specified. Additionally, the NPRM proposed to require that: Roof exits have a forward hinge and comply with the emergency release requirements of S5.3; emergency exit doors have a device to cause them to remain open

once they have been opened past a certain point; seats adjacent to side emergency exit doors have flip-up seat bottoms; and the outline of school bus emergency exits be marked with retroreflective tape on both the interior and exterior sides of the bus.

NHTSA received 29 comments in response to this NPRM. All of these comments were considered while formulating this final rule, and the most significant comments are addressed below.

The most significant difference between the final rule and the NPRM concerns the means by which the additional emergency exit space will be provided. The requirement in the final rule is most similar to Option B in the NPRM, in that the first additional exit must be a side door and the second additional exit must be a roof exit. However, the final rule allows manufacturers to choose between side door exits, roof exits, and window exits in providing any additional required exit space. Additionally, the exact location of additional emergency exits is no longer specified. The final rule also differs from the NPRM in the types of markings that must be provided for emergency exits.

1. Capacity-based Emergency Exit Requirements

The NPRM proposed to require that school buses provide minimum emergency exit spaces equal, in square inches, to 67 times the number of seating positions. Several commenters, including the National Transportation Safety Board [NTSB], the National School Transportation Association [NSTA], and several states, specifically voiced support for capacity-based emergency exit requirements for school buses. However, the Minnesota Department of Education [Minnesota] stated its belief that "the rule as proposed goes too far in trying to prevent or minimize damages from events that are extremely rare. Greater safety can be provided by targeting funds to other areas, such as driver training." The agency acknowledges the extremely safe record of school buses, but believes that it is important to safeguard against catastrophic-type crashes by ensuring that the occupants of school buses have adequate amounts of emergency exit space located in several locations throughout the bus. This is particularly important as more higher-capacity school buses are being manufactured. Based upon information in the annual statistical issue of "School Bus Fleet Magazine," in comparing 1991 to 1987, the number of Type C buses (24–76 passengers) sold decreased by approximately 8,000, while the number of Type D buses (78 passengers and over) sold increased by approximately 5,600.

Additionally, while the agency recognizes the importance of school bus driver training programs, it notes the importance of school bus drivers having the best equipment available to them in order to do their job. Even the best drivers cannot do their best with inferior equipment. Conversely, the best equipment in the hands of untrained drivers does not guarantee the safe operation of a school bus.

The Oregon Department of Education [Oregon] agreed that a capacity-based method for determining the amount of emergency exit area should be adopted, but stated that using the same formula leaves a discrepancy between school buses and non-school buses. Oregon believed that school buses establish the maximum seating capacity based on a 13 inch wide seat space per individual, while non-school buses use a 15–18 inch space for a seating position. Oregon suggested this difference be taken into consideration by either developing "a more compatible seating position definition * * * or by utilizing a reduced square inch criteria * * * for the determination of number of required exits."

There is no specific mention of a 13 inch seating width in any safety standard. Oregon apparently based the 13 inch figure on the requirements of Standard No. 222, *School Bus Passenger Seating and Crash Protection*. Section S4.1 of Standard No. 222 calculates the maximum number of seating positions on a school bus bench seat by dividing the seat width by 15, and rounding the result to the nearest whole number. Using the industry "standard" seat width of 39 inches, the calculated maximum number of seating positions is 3 ($39/15 = 2.6$, rounded to 3). If one then divides the actual seat width (39 inches) by the calculated maximum number of seating positions (3), a 13 inch seating width can be inferred. This requirement is intended to ensure that the seat will be constructed to provide adequate crash protection when occupied by the maximum number of passengers. Many of those passengers are likely to be younger and smaller than the typical passengers who ride in non-school buses.

It appears that Oregon's concerns stem from the resulting number and cost of additional emer-

gency exits for school buses. If the agency adopted Oregon's suggestions for calculating the total amount of emergency exit space, a smaller number of exits would result. The agency believes that it is appropriate to base the emergency exit requirements for school buses on the maximum potential capacity of the bus rather than a lesser number, just as it is appropriate to base the crash protection requirements on the maximum potential capacity of each seat. School buses are often operated at or near capacity. Further, it is important to ensure that adequate emergency exit space is available no matter whether the school bus is filled with kindergarten-size students or high school-size students. Therefore, the final rule provides that "(t)he area in square inches of unobstructed openings for emergency exit shall collectively amount to at least 67 times the number of designated seating positions in the bus."

2. Option A (Emergency Exit Doors) or Option B (Doors and Roof Hatches)

As explained previously, the NPRM proposed two options for adding emergency exits to school buses. Option A would have required that only side emergency exit doors be installed to meet the proposed additional emergency exit requirements. Option B would have required that a combination of side emergency exit doors and roof hatches be installed to meet the additional emergency exit requirements.

Several commenters expressed support for Option A. However, many of these also expressed support for roof hatches. For example, Oregon stated that Option A "appears to provide the most equal distribution of emergency exits," but "recommended that Option A be amended to include at least 1 roof exit."

Most commenters expressed support for Option B or a variation of it adopted by the 11th National Conference on School Transportation. But many of these commenters also expressed support for even greater usage of roof hatches than Option B would have required. For example, the Arizona Department of Transportation [Arizona-DOT] noted that buses with a capacity of "48 passengers or less should be required to have at least one roof hatch." The Iowa Department of Education [Iowa] stated that Option B should be adopted, but that it should be "amended to require at least one emergency roof escape for most, if not all school bus applications."

Only the Colorado Department of Education [Colorado] expressed total opposition to roof hatches, and therefore to Option B. It expressed technical concerns with roof hatches, particularly the "draft effect" of a roof hatch in a fire, as well as the potential dangers of dripping plastic from the hatch in a fire. Colorado also questioned whether or not the installation of a roof hatch would compromise a bus's ability to withstand rollover crashes. (A discussion of these concerns appears under Section 5, Roof Exits—Design and Size.) Further, it noted that in 5 years, only .7 percent of the Colorado school bus crashes have involved a bus rolling over on its side. This means that "(s)tudents would not have had the need to use roof hatches as an exit 99.3% of the time."

A number of commenters expressed strong convictions on the efficacy of various types of emergency exits. The NSTA supported "the use of push-out windows, side door or roof hatches to meet the emergency exit space requirements. The type of exit used to comply with the requirement should be the choice of the purchaser and manufacturer." The Montana Office of Public Instruction [Montana] believed that the states should have "some choice in choosing emergency escape windows, doors or roof hatches."

The Eagle County Colorado School District [Eagle County] noted that while it supported the need for more emergency exits, it believed "(d)ifferences among school districts such as in terrain and types of pupils transported must necessitate local decisions on the number, type and location of emergency exits." The Salem-Keizer Oregon Public Schools [Salem-Keizer] supported the agency's proposals for establishing emergency exit requirements based on school bus capacity, however, it believed push-out windows serve a useful purpose. It liked the "approach for providing a variety of exits for meeting a variety of uncertainties," and asked that the agency not "rule against push-out windows!"

Based on the comments, the agency believes that there are benefits to providing a variety of emergency exit types distributed throughout the bus as a precaution against a wide variety of potential emergency exit situations. Roof hatches would be a very beneficial type of emergency exit when the bus is on its side; however, it would be difficult for many students to use roof exits in other situations. It is also possible to envision a

situation in which a bus comes to rest in a position where one or more emergency exits on a side would be too close to a tree, pole, guardrail, bridge abutment or other vehicle to allow it to open, or to open completely. In such an instance, it would be useful to have emergency exits distributed in other areas of the bus. Accordingly, the agency has decided that school buses should have a variety of exit types distributed throughout the passenger compartment.

The agency has determined that after calculating the total amount of additional emergency exit area [AEEA] needed for a school bus, using the formula proposed in the NPRM, the first additional amount of emergency exit area must be met with a side emergency exit door; the second additional amount of emergency exit area must be met with an emergency roof exit. Unlike Option B in the NPRM, however, the final rule provides that any remaining emergency exit area can be met with either a side emergency exit door, a roof emergency exit, or an emergency exit window. The specification of a side emergency exit door as the first priority is consistent with the NPRM which noted that, "if a bus is required to have only one additional exit * * *, that exit should be a side exit emergency door." Allowing AEEA to be met with an emergency exit window in some circumstances, however, differs from the agency's position in the NPRM.

In the NPRM, the agency stated three reasons why it did not want to encourage the use of push-out windows. First, push-out "windows are usually higher off the ground and smaller in size than exit doors, which make them difficult for school age occupants to use." Second, "push-out windows are almost never used as a means of escape during school bus evacuation drills." Third, "push-out windows are likely targets of tampering." (56 FR 11153, 11155)

Nearly all commenters responding to the NPRM expressed an opinion concerning push-out windows. Most of these comments were based on the commenters' own successful experiences with such devices. For example, the Lake Oswego Oregon School District [Lake Oswego] stated that it has used push-out windows for nearly twenty years and that push-out windows "are at no greater risk of 'tampering' than any other emergency exit. (T)hey certainly are of less of a threat of students falling if they 'play' with them, than a side door." Minnesota believed that "pushout windows will maintain structural integrity of the vehicle better than numerous side emergency doors." Summing up the sentiment of commenters like these, Blue Bird stated that "(i)n the final analysis, State governments have the ultimate responsibility for selecting the features that they believe will best protect the safety of the passengers they transport."

Given the almost uniformly negative response to the agency's position on push-out windows, the agency reexamined its position. First, given the experiences with tampering reported by the commenters and that students may be sitting near side emergency doors, the agency no longer believes that push-out windows are a more likely target for tampering than an emergency exit door. While the agency continues to believe that push-out windows are less likely to be used in an emergency, the agency does not have any accident data to suggest that these windows are unsafe. Given that a large number of school districts currently require push-out windows in addition to the requirements of Standard No. 217 and have not reported any problems with them, the agency has been persuaded to allow push-out windows to be counted towards the AEEA requirements for some buses. Since the first amount of AEEA must be met with a side emergency door, the second amount of AEEA with a roof exit, only large-capacity buses, typically those with a seating capacity exceeding 70, will be able to take advantage of this option.

NHTSA suggests that States and school districts consider the agency's concerns about the use of push-out windows when choosing between side doors, roof exits and push-out windows for larger school buses. For States and school districts that allow or require push-out windows in school buses, the agency suggests further that training programs include instruction in the use of these windows.

3. Emergency Exit Doors

While there were a number of comments to the docket in support of requiring only emergency exit doors and roof hatches, some commenters expressed concerns over the structural impact of additional side emergency exit doors. Thomas Built Buses [Thomas Built] stated that in terms of intrusion, it has been shown "that the structural integrity of the area around the side emergency door can be just as sound as an area along the

side of the bus that does not have a side emergency door." However, on the subject of fatigue strength, Thomas Built has "seen evidence that the bus's fatigue strength has been compromised when a side door is installed on various types and brands of buses. This evidence shows up after years of use and is in the form of cracked structural members and panels." The placement of the door, depending on the "body length, front engine, rear engine, and operating conditions," can have "detrimental effects on structural fatigue." "Problems can show up early (1–2 years) or later (3–10 years)."

The agency does not believe the fatigue strength concerns expressed by Thomas Built are unique to side emergency exit doors. In-use fatigue problems can result from a variety of operational factors, including climate and roadway factors, that can affect many areas in all types of buses.

With respect to these "fatigue strength" concerns, the agency notes that: (1) rear-engine school buses have been equipped with a left side emergency exit door since 1977; (2) several States (e.g., California, New York, and Washington) already require additional side emergency doors in their school buses; (3) a large number of school buses are equipped with wheelchair lifts which essentially represent an oversized side emergency exit door; and (4) these buses do not appear to be suffering from large numbers of design structural integrity problems or fatigue strength life cycle problems. For these reasons, the agency believes requiring a single side emergency exit door in school buses currently equipped with a rear emergency door or an additional side emergency exit door on a school bus with a left side emergency exit door will not compromise the structural or life cycle characteristics of school buses.

4. Window Size

Three commenters directly addressed the size of the standard (non-emergency exit) windows on school buses. These comments attempted to separate emergency evacuation situations into two types. The first were the routine evacuations where time is not necessarily critical and the service entry door and other floor level emergency exits would be utilized. The second were catastrophic-type crashes where the school bus occupants have to evacuate the vehicle as fast as possible. In its comments to the NPRM, the California Department of Education [California] noted that "NHTSA could have also enhanced passenger safety by requiring the passenger window opening to be at least 12″ by 22″ in area." (Currently, most school buses are built with split-sash windows which drop to provide an opening of 9″ high x 22″ wide.) California stated that while each window should not be a designated emergency exit, "a larger window opening would provide passenger(s) in each seat location direct egress from the bus in a catastrophic accident similar to the accidents in Carrollton, Kentucky and Alton, Texas. Many lives may have been saved if only the passenger windows would have provided a large enough opening to permit the passengers to escape." A similar comment was submitted by Washington.

TAM–USA stated that one of the conclusions from the NTSB's investigation of the Alton, Texas, school bus crash was that "larger vertical openings of the side windows would have improved the occupants' ability to escape." TAM–USA further commented that establishing minimum window size openings as a:

> remedy for total and immediate evacuation from catastrophic accidents * * * serves a number of purposes. First, it recognizes that such accidents are unique, and normal rules of, and training for, evacuation in such accidents do not apply. Second, it recognizes that no single set of measures can address every possible accident scenario. Third, addressing the problem in this way permits NHTSA to focus the rest of its thinking and logic on the vast majority of accidents which are not catastrophic, and to which passenger training and coordination with safety features can produce optimum and measurable results.

Finally, TAM–USA stated that in the Alton crash "push-out windows would not have worked, since each window would have had several hundred pounds of water pressure on it." Accordingly, it believed "simple sliding passenger windows, with large window openings, are far less expensive, could be applied to the entire bus, and do not possess most of the problems associated with push-out windows."

Along the same vein, Blue Bird stated that it has several side emergency exit designs under development, including a vertical slide open window and side exit hatch or shorter emergency exit door. In order to encourage, and certainly not to prohibit, further development and use of these

types of exits, Blue Bird believed language should be included in the school bus requirements that would provide for emergency exit side windows with a maximum amount of credit of 536 square inches.

While the agency understands the comments concerning the wisdom of larger standard windows in school buses to facilitate evacuation during catastrophic situations, it is concerned about the potential negative aspects of larger windows. Specifically, the agency is concerned about the greater potential danger to a child who sticks a hand, arm, or head out of the window while the bus is in motion. It is clearly easier for a child to hang out of a 12 inch x 22 inch window than a 9 inch x 22 inch window. The agency recognizes that some state and local school districts are currently using school buses with larger windows, without large numbers of incidents where children are hurt because of them. Taken all together, the information available to the agency appears to provide some evidence that the potential benefits may be greater than the potential risks.

As was stated in Washington's comments, states do not want "every school bus window to be considered a designated exit." If windows were so regarded, each of them would be required to meet the Standard No. 217 requirements for emergency exits, including audible warnings, locking devices, labeling, etc. Also, as was stated in the TAM-USA comments, the importance of evacuation routes at every seat is relevant only in catastrophic crashes. Since the overwhelming majority of school bus evacuations do not occur in connection with catastrophic crashes, the agency believes there is a need for designated emergency exits, which can be accomplished with doors, hatches, and/or push-out windows. However, the agency does not believe there is sufficient justification to support a Federal mandate for non-designated emergency exits, which could be obtained from larger school bus window openings throughout the bus.

Accordingly, while the agency supports the concept of each student having a personal escape route, whether it be through a designated or non-designated emergency exit, it does not believe there are sufficient grounds for establishing minimum window opening sizes for non-designated emergency exits. However, the agency notes that the use of larger windows is permissible for those states that wish to have them.

5. Roof Exits—Design and Size

Support for roof exits came from a wide range of commenters. As noted earlier, some commenters (Iowa and Arizona-DOT) went so far as to state that all school buses should be equipped with at least one roof hatch. Only Colorado expressed concern about roof exits, particularly in a fire situation where a roof hatch could create a "chimney effect" and worsen the fire. While Colorado is correct that an open roof hatch would create a chimney for smoke and heat to escape, such a result is desirable. Heat and smoke are at least as much of a threat to bus occupants as the fire itself. While the open roof hatch would help vent heat and smoke out of the bus, it can also result in more oxygen being drawn into the bus. While this additional oxygen will provide additional "fuel" for the fire, it will also provide additional oxygen for anyone in the bus. On balance, the agency believes the positive aspects of open roof hatches in a bus fire outweigh any potential negative aspects.

A number of commenters discussed their beliefs that recessed roof hatch requirements, as mentioned in the NPRM, would be more susceptible to binding in a crash and would require some type of internal draining system that would add cost to the bus. Thomas Built stated that "(r)ecessing the hatch would create greater problems than the 'predicted' problem attempting to be solved." It cites potential jamming from body twist, as well as water drainage (and rust) problems. Blue Bird stated its belief that current roof hatch designs are safe and added that it does not support recessed designs because they are "more likely to be jammed shut in an accident." Two roof hatch manufacturers, Transpec and Salem Vent International [Salem Vent], also agreed that recessed vents would be more susceptible to binding in a crash, and believed that the current overlay roof hatch designs are the best. Based on these comments, the agency does not believe that overlay roof hatches are a safety problem or that it is necessary to require recessed roof exits.

A number of commenters addressed the issue of roof exit size. The preamble to the NPRM stated that, "The maximum credit for one roof exit would be 540 square inches, regardless of its actual size." The proposed regulatory language stated that, "The roof exit shall provide an opening with a minimum clearance of 16 inches and an area of at least 540 square inches." Only

Thomas Built makes a roof vent that meets the 540 square inch requirement proposed in the regulatory text. There are no other known manufacturers of a roof hatch that large. Transpect stated that they believe the proposed size requirements "will obsolete virtually every roof exit design currently available; and force bus body manufacturers and equipment suppliers to spend potentially millions of dollars in re-designing and re-tooling." It suggested a minimum size of 20″ x 20″, which is "about 50% larger than the current minimum size" and will allow passage of the 13″ x 20″ ellipsoid currently required for push-out windows under S5.2.2(b) of Standard No. 217. Other commenters stated that additional leadtime would be needed while existing roof exits were redesigned to meet the minimum area requirements.

After reviewing the comments to the docket on this topic, the agency has decided to delete the requirement that the roof hatch have an area of at least 540 square inches. The agency was not aware that current roof exit designs did not meet the proposed requirements. However, the agency believes that a minimum size must be specified for roof hatches. Therefore, consistent with the NPRM, each open roof hatch must provide an unobstructed space of not less than 16 inches by 16 inches. As with all other openings, there is no limit on the maximum size of the opening. The regulatory language has been revised accordingly.

The NPRM also proposed that roof exits be operable from the outside to assist rescue personnel in being able to open a roof hatch on an overturned school bus in an emergency situation. Since no commenters objected to this requirement, it is included in the final regulatory language.

6. Location of Emergency Exits

The NPRM proposed amending existing S5.2.3.1, governing minimum emergency exit locations, to specify the location of the additional exits required by Options A and B. The NPRM stated, "(t)he agency is concerned that the required exits maximize emergency egress while not compromising the structural integrity of the vehicle." The NPRM then proposed specific locations for the additional exits under both Options A and B.

All of the comments concerning the location of any type of emergency exit supported the concept of an even distribution of the exits around the bus. However, the locations proposed in the NPRM were not always deemed possible or practicable. For example, Thomas Built stated that the left side emergency door on rear engine buses "cannot be placed at the extreme rear section * * * because of the interference with the engine compartment/davenport seat." Additionally, the company said that the left and right side emergency exit doors should not be "within the same post and roof bow panel space."

Blue Bird stated that because of design restrictions related to such items as wheelhousings, fuel filler necks, seat placements, etc., there are a number of problems in specifying side door locations. Accordingly, Blue Bird "strongly recommends that NHTSA conduct further research to determine the effects and feasibility of requiring specific exit locations."

Other commenters endorsed the even distribution of emergency exits, but believed that states should have the flexibility of establishing the location of emergency exits. California believed "(t)he location of the side exit doors and roof vent/exits should be optional to each state."

Washington, which has required additional side emergency exit doors on most buses since 1954, supported the concept of specifying the locations of emergency exits. Its experience indicated that if the locations of emergency exits are left to the discretion of the manufacturers, doors could be installed in a manner that "meets the letter of the law * * * (but) does not meet the intent of the requirement."

Transpec commented that when two roof exits are utilized, "they should be located equidistant between the mid-point and the front and rear of the passenger compartment * * * in other words the forward ¼ and the rearward ¼ of the overall passenger compartment length." This differs from the proposal of the forward ⅓ and rearward ⅓. Transpec stated that its alternative would better minimize the distance any single passenger would have to travel to reach a roof exit.

Based on the above, the agency has concluded that there are legitimate technical issues relative to establishing specific locations for side door exits in school buses. Differences in chassis and body designs among manufacturers would necessitate the establishment of standards on a make/model basis, which could hinder school bus safety improvements in the future. The agency has con-

cluded that emergency exits should be evenly distributed throughout the bus, to the extent possible. For example, if an emergency exit door is added to a school bus with an existing rear door emergency exit, the additional door must be located on the left side of the bus and as close to the center of the bus as is practicable. If an emergency exit door is added to a school bus with an existing left side emergency exit door, the additional door must be located on the right side of the bus.

With respect to roof hatches, the agency agrees with the location specifications suggested by Transpec because these specifications minimize the distance from the roof exits to the farthest school bus seat. Therefore, the agency has concluded that when a single roof hatch is installed in a school bus, it must be located as near as practicable to the longitudinal mid-point of the passenger compartment, and must be installed such that the centerline of the hatch is on the longitudinal centerline of the bus. When 2 roof hatches are utilized, they shall be located as near as practicable to the points equidistant between the longitudinal mid-point of the passenger compartment and the front and the rear of the passenger compartment. When multiple roof hatches are utilized, they may be installed either on the longitudinal centerline of the bus or offset from the centerline. For each roof hatch that is installed in an offset manner, there must be another roof hatch offset an equal amount to the other side of the centerline.

If a state chooses to install emergency exit windows in order to satisfy some of the exit space required by the standard, there must be an even number of such windows and they must be evenly distributed between the left and right side of the bus.

Consistent with giving states the flexibility of selecting some of the types of emergency exits used (doors versus hatches versus windows), the agency has concluded that states are in the best position to specify the exact locations of emergency exits on school buses. The final rule, therefore, establishes general requirements for school bus emergency exit locations. The agency anticipates that the individual states will include more specific location information in their school bus specifications and work with the school bus manufacturers during the construction of their school buses to establish emergency exit locations that provide for the safe, organized, and efficient egress of passengers from all school bus seats.

7. Improved Access to Emergency Exits

The NPRM proposed that if school bus manufacturers placed seats adjacent to a side emergency exit door, those seats must have flip-up bottoms in order to provide a path to the door. The path would have been somewhat less than 24 inches wide. The location of the path in relation to sides of the door opening would have been fixed by a reference to the forward edge of the door. If this proposal were adopted, manufacturers not wishing to install flip-up seats would have had the option of complying by providing an open aisle to the side door. Under that option, the aisle would have extended the full width of the door, a minimum of 24 inches.

The agency considered, but tentatively rejected, two more costly alternatives. One would have required the unobstructed passage of a rectangular parallelepiped (12″ x 24″ x 45″) through each side door opening a distance of one foot inside the outside door frame edge. The other would have required the unobstructed passage of a rectangular parallelepiped through the door opening all the way to the center of the aisle, thereby creating a dedicated aisle to the side door. The path to the door created by the passage of the parallelepiped would not have been referenced to either the forward or the rearward edge of the door. Although the agency tentatively rejected both of these other options, the agency sought comment on them to aid in determining what requirements regarding access should be adopted.

Several states and school districts, two bus manufacturers, and a national association supported the proposal to require that seats adjacent to side emergency exit doors have flip-up seat bottoms. Oregon, Salem-Keizer, Minnesota, Eagle County, Thomas Built, TAM–USA, and NSTA indicated that they preferred providing a flip-up seat at side emergency exit doors, instead of a dedicated aisle, primarily because of perceived capacity loss and resulting additional costs associated with the latter alternative. Thomas Built commented that if an aisle were mandated, the aisle should have a minimum width of 12 inches.

Several states supported dedicated aisles. Maryland did not support the use of flip-up seats. It did not believe a child should be allowed to sit next to a door, and that a clear aisle leading to

the side door is just as important as a clear aisle leading to the rear emergency door. Washington preferred "a clear aisle to the side door." Washington added that it was "aware of the concern for lost seating capacity. However, unless the bus is already at maximum length, adding a longer bus body will regain any loss in seating capacity." While Washington did not have production data, it suspected that most buses are not produced at maximum length.

Washington also noted that it has recently started purchasing flip-up seats and has already had "two incidences reported where children have stepped on the seat cushion in a fashion that allowed the leg to become lodged in between the seat cushion and the seat back. Once the leg was stuck, it was a major task to dislodge the leg. Such an occurrence would have been a disaster if it happened when the bus was being evacuated because of an emergency." For this reason, Washington believed that "(i)f the flip-up seat is allowed, there needs to be a performance requirement that will not allow a child's foot to slip through the space between the seat cushion and seat back."

Blue Bird favored requiring a dedicated aisle at least 12 inches wide. It expressed concern that "there is limited experience with the use of side emergency doors and access to these doors." Only four states require additional side emergency exit doors, and "two have no seat alignment or aisle clearance requirements to these doors." Blue Bird noted that Washington has recently required seat alignment and a clear aisle, and Kentucky has recently required a staging area at side emergency doors. Kentucky's requirement appears to have been adopted in response to the Carrollton, Kentucky crash. However, "(n)o field experience with this exit configuration has been accumulated."

Blue Bird stated that the installation of a flip-up seat at side emergency exit doors instead of a dedicated aisle does not always eliminate a loss of capacity. It also noted that it is "not aware of a flip-up seat design that assures proper functioning in all circumstances or that will totally eliminate possible pinching or entrapment potentials." Blue Bird further stated its concern that in "certain accident scenarios, occupants could be thrown off the seat cushion, allowing it to flip up, and then be rebounded into the upright cushion which allows the potential for injury." Blue Bird cautioned "NHTSA to thoroughly evaluate the proposed requirement for flip-up seats at side emergency doors before specifying their use."

In view of the concerns expressed by commenters regarding flip-up seat bottoms, the agency believes that the preferable manner of providing access to side emergency exit doors is through creating a dedicated aisle. However, the agency recognizes that some states believe flip-up seats are reasonable alternatives to providing access to side emergency exit doors. While recognizing there are some advantages to a dedicated aisle over a flip-up seat, the agency does not believe there is sufficient justification or experience to require dedicated aisles. Accordingly, the agency has decided to permit either dedicated aisles or seats with flip-up bottoms. The current Standard No. 217 language which allows a standard school bus seat to be next to a side emergency exit door has been eliminated. No special provisions have been adopted to address the issue of entrapment since the agency lacks sufficient information to specify performance requirements for flip-up seats.

The NPRM also requested comment on whether the agency should allow a tolerance in the relationship of a seat back to the forward edge of a side emergency door opening. Thomas Built and Blue Bird suggested that the proposed language regulating the location of a seat back in relation to the forward edge of the side emergency door could be misinterpreted. Thomas Built suggested that the S5.4.2.1(b) language be: "A vertical transverse plane tangent to the rearmost point of a seat back shall pass through any points between 0.5 inches forward of the forward edge of the door opening and 0.5 inches rearward of the edge." Blue Bird also suggested rewording of this section to say that: "the seat back shall be positioned such that the vertical transverse plane passes anywhere between points .5 inches forward or rearward of the door opening." Washington also agreed that some flexibility in seat back location relative to the side door must be allowed and suggested a "tolerance of one-half of the manufacturers seat back thickness."

After reviewing the proposal and the tentatively rejected alternatives, as well as the public comments, the agency has determined that a provision requiring that there be a seat back aligned with the forward edge of each side emergency exit door would be unnecessarily design restrictive,

even if the agency were to provide a tolerance of 0.5 inches. Since the requirement has the effect of requiring that a seat be installed immediately forward of a side door opening, it could have undesirable consequences. For example, a manufacturer would be prohibited from placing a wheelchair securement location in that area, even though the areas near a side door might be the most logical area if a wheelchair lift were installed in that door.

However, the agency has determined that the location of the path to the door should be referenced to the real edge of the door to ensure access to the door release mechanism. Because side emergency exit doors are required to be hinged on their forward edge, the release mechanisms are located near the rearward edge of the door. Therefore, the agency has decided to require an aisle at least 12 inches wide, referenced to the rear edge of the emergency exit door. In addition, no seat or restraining barrier will be allowed to extend rearward of the forwardmost portion of the latch mechanism when it is in the latched position. Some latch mechanisms include a long lever that extends well forward of the 12 inch clear aisle required by this rule. A flip-up seat is allowed in the aisle area adjacent to a side emergency exit door so long as no portion of the seat bottom is within this aisle area when the seat bottom is in the up position.

8. Three-Point Door Latch

The NPRM requested comment on the likelihood of side door ejections because of additional side emergency exit doors on school buses. Additionally, the agency requested comment on whether additional or improved door exit mechanisms (e.g., a 3-point latching mechanism with latch points at the top, bottom, and side of the door) would reduce the risk of ejection.

Several state and local school districts supported the concept of providing multiple latches on side doors. Washington, for example, voiced its support by noting that "(a)ny time there are multiple latches to fail, the probability of failure is reduced." Washington and Eagle County believed that 3-point latches should be used on rear emergency exit doors as well. Oregon supported a 3-point latching mechanism, provided it is "based on test data and the vehicles ability to meet overall construction standards."

Blue Bird and Thomas Built stated that a side emergency exit door retention test would be more appropriate than requiring a 3-point latching mechanism. Thomas Built noted that passengers would not be ejected through current side emergency exit doors because of inadequate latching mechanisms. It stated that "(p)assengers inside the bus, impacting the door, would not exert enough force to cause the latch to fail." Thomas Built believed that "(a) detrimental effect from the three-point latch is possible jamming" in a crash. Blue Bird also asserted that "a 3-point latch mechanism could result in increased susceptibility to jamming in an accident."

No commenters provided any information to suggest that side emergency exit doors on school buses are currently at potential risk of opening in a crash. The agency is aware that the July 1991 crash of a school bus in Palm Springs, California, in which the school bus body separated from the bus chassis and was severely twisted during the high-speed crash into a series of large boulders, resulted in the opening of the left side emergency exit door. The National Transportation Safety Board has not completed its investigation of that accident to determine if there were any passengers injured or killed because of the door opening during the crash. The structural damage to the bus body was so severe that it is hard to imagine that multiple door latches would have kept the door closed. The door appears to have opened due to severe damage to the bus body, not because a passenger was thrown against the door.

After considering the comments of school districts and the bus manufacturers, the agency has concluded that, if a side emergency exit door retention problem existed, it would be more appropriate to develop a door retention test, rather than specifying a specific type of latching mechanism, e.g., a 3-point latch. Even with the recent crash in Palm Springs, California, the agency does not believe there is a safety problem with side emergency exit doors opening due to the force of passengers being thrown against them. Additionally, as with emergency roof exits, the agency is concerned about establishing requirements that could increase the potential for jamming shut in a crash, as was suggested by Blue Bird and Thomas Built. Accordingly, the final rule does not include requirements for a 3-point latching mechanism for side emergency exit doors.

9. Positive Door Opening Device

The NPRM discussed the agency's belief that an exit should not only be reachable, but also not shut once it has been opened, regardless of the orientation of the bus after a crash. The agency's concern was directed specifically to emergency exit doors. Accordingly, the NPRM proposed that each emergency exit door "be equipped with a device capable of bearing the weight of the door and keeping the door from closing past the point that is perpendicular to the side or rear of the bus once the door is opened to that point."

The NTSB expressed its support for a device that would hold an emergency exit door open "to accommodate passenger egress, particularly in a rollover situation." This was one of the recommendations that was included in the NTSB's report on the September 1989 Alton, Texas, school bus crash. Two bus manufacturers and four states also expressed their support for such a device. Thomas Built and Washington also noted that such devices were included in the requirements of the 11th National Conference on School Transportation. Blue Bird requested an opportunity to comment on the technical performance requirements of such a device before it becomes a final rule.

Based on the above support for such a device, the agency has concluded that a device to keep floor-level emergency exit doors from shutting after they have been opened is necessary on school buses. The requirements specified in the NPRM have been adopted. The technical requirements for this aspect of Standard No. 217 are identical to those included in the NPRM. Therefore, the agency does not believe the opportunity requested by Blue Bird to review further the technical requirements of this device is merited.

10. Improving the Conspicuity of Emergency Exits

A number of commenters supported the proposal to improve the conspicuity of emergency exits. However, there were some differences of opinion on how to accomplish the improved conspicuity. The NPRM proposed to require a 1-inch wide strip of retroreflective tape to outline the inside and outside perimeter of each designated emergency exit opening. Additionally, the agency sought comment on whether school buses should be required to have an interior light source to illuminate the retroreflective tape around the interior perimeter of emergency exits at night.

Blue Bird commented that it is "unaware of any problems or concerns regarding emergency exit identification or operating instructions under the current exit requirements" and suggests that NHTSA "establish and document a need for such markings before including this requirement in the final rule." It strongly recommended "that NHTSA construct and evaluate prototype vehicles and/or conduct field tests of this proposed requirement before finalizing the rule." Thomas Built also suggested that the effects of standard interior lighting on driver's night vision be studied. Transpec commented that reflective markings of roof exits would "not be difficult to accomplish" but questioned whether the need for such markings had been "established" and said that the "cost-effectiveness of such expenditures might be questioned."

Minnesota did not believe retroreflective tape should be required at emergency exits. First, it noted that "(s)tudents usually ride the same bus every day and usually during periods of time when there is adequate light." Second, Minnesota is "particularly concerned that reflective material on the inside of the vehicle would create vision problems for the driver at night. The light from oncoming vehicle headlights could reflect off the material and back to the driver's eyes via the inside mirror or the windshield."

Thomas Built also stated that since retroreflective tape requires "a direct beam of light originating from the point of the observer" to function properly, it is unlikely that retroreflective tape would perform well on the inside of a school bus. "A stripe of fluorescent paint would probably be more useful than the reflective tape with respect to background lighting without direct lighting." "Retroreflective tape would work best on the outside of the exits where it is likely to be illuminated by rescuers or passing car headlights." Several other commenters, such as NSTA, West Virginia, and Salem-Keizer, supported the use of reflective markings on emergency exits.

Oregon supported making emergency exits more visible, but believed that establishing a "labeling criteria for emergency exits to include a retroreflective background material" is better than merely adding a 1-inch stripe of tape around the perimeter of the exit. Even in no-light or limited-light conditions, the words "Emergency Exit" would be at least as visible as currently

required. It based this recommendation on the fact that retroreflective tape is used for many other purposes around school buses in various states, as well as on other vehicles, and it may not be clear what the tape represents. Using retroreflective tape to call attention to the words "Emergency Exit" seemed more reasonable to Oregon.

Washington believed all emergency exits should be identified on the interior and exterior, and should be labelled with instructions for use. "These instructions and location markings will benefit students who walk to school and only ride school buses on field trips and extracurricular trips."

3M Traffic Control Materials Division [3M] agreed with the proposal to provide retroreflective markings at all emergency exits and provided the necessary technical information, in terms of Minimum Specific Intensity per Unit Area (SIA), for the color yellow. The NPRM proposed to use the intensities from Standard No. 125, *Warning Devices,* which only covers the colors red and white. 3M noted that the "(r)eflective emergency exit markings visible from the exterior of the bus have the other benefit of alerting motorists. This provides an added benefit of accident prevention." However, 3M believed "a two inch wide strip is needed (at the rear emergency exit) to provide the important added benefit of crash avoidance made possible by making the vehicle visible at greater distances by fast approaching motor vehicles during times when headlights are being used. This two inch strip is consistent with the dimensions of other similar strips recommended in the 1990 National Standards for School Buses and Operations."

3M stated that "(w)hen retro-reflective markings are used in the interior of school buses equipped with passenger compartment electric lights, the reflective markings provide the added benefit of enhancing identification of exits while lights are operable. In situations where the electric system fails to function during the post crash situation, the reflective material will return light to any light source within hundreds of feet of the bus. Examples of these light sources include rescuer flashlights, street and building lights and motor vehicles, to name only the most common sources."

Finally, 3M felt that the interior markings "would be considerably more valuable if the markings were both retro-reflective and fluorescent and therefore highly visible even during all light conditions without presence of a (sic) artificial light source of any kind."

After review of the above comments, the agency has concluded that there are legitimate concerns over the efficacy of requiring retroreflective tape on the inside perimeters of emergency exits. The agency believes that the issues raised by Minnesota and Thomas Built, with respect to mandatory interior lights and light reflected into the eyes of the driver, are legitimate. On the other hand, the agency has concluded that retroreflective tape identifying the outside perimeter of emergency exits has significant potential benefit, for both post crash rescue and crash avoidance because of enhanced conspicuity of the bus. Accordingly, the final rule requires a minimum 1 inch wide strip of retroreflective tape, either red, white, or yellow in color, to be placed around the outside perimeter of the emergency exit opening, not the emergency exit itself. The required reflectivity properties of the tape will be provided in a Table, consistent with the requirements for the reflective material allowed under Standard No. 131, *School Bus Pedestrian Safety Devices.*

11. Hinge Placement for Roof Exits and Side Emergency Exit Doors

The NPRM proposed that roof hatches be hinged on the forward edge and that side emergency exit doors be hinged on the forward edge, as is currently required by Standard No. 217 for a single left side door.

Transpec and NSTA supported the forward hinging for roof hatches, and the agency has adopted such a requirement in the final regulatory language.

Thomas Built Buses noted an error in the proposed wording of S5.2.3.2(b) under Option B. The proposed language required a left side emergency door which is hinged on its "rearward" side, rather than its "forward" side. This error is corrected in the final regulatory language.

12. Warning Alarms for Roof Exits and Side Emergency Exit Doors

The NPRM proposed that all emergency exits be equipped with a continuous audible alarm at the driver's position that sounds when the ignition is in the "on" position and the emergency exit release mechanism is not in the closed position.

Transpec commented that roof exits do not need to be equipped with alarm devices because: (1) Roof exits are in "areas where it's virtually impossible for passengers to lean against them * * * let alone accidently fall through one;" (2) unlatched roof exits (for ventilation purposes) are seen in real-world operations, and an alarm "could distract the driver's attention"; and (3) "requiring alarms on roof exits will serve to discourage retrofit installations of roof exits on school buses * * * something that should be encouraged."

The Arizona Department of Public Safety [Arizona-DPS] forwarded a copy of their proposed State school bus specifications which include audible alarms for emergency exit doors and emergency exit windows, as required by Standard No. 217, but do not propose to require audible alarms for roof exits.

California, NSTA, and Blue Bird expressed support for audible alarms on emergency exit doors and emergency exit windows.

The agency agrees with the comments by Transpec and others, that there is no safety need for an audible alarm on a roof exit. Unlike doors or windows, it is unlikely that someone could accidently fall out of the bus through a roof exit. Additionally, the requirement for such a device would make retrofitting of a roof exit significantly more difficult. For these reasons, the final regulatory language does not require an audible alarm for roof exits.

13. Combination Roof Exits and Roof Ventilators

Transpec, California, and Iowa commented on roof ventilators. Transpec stated its belief that the standard should include a specification for a "combination roof ventilator/exit," since that would "result in a specification that coincides with established industry practices." California stated that "revisions to the roof exit language to permit the use of the * * * (combination) roof exit/vent is strongly encouraged." Finally, because of the positive operational aspects of ventilation roof hatches, Iowa believed that "(a)ny standard that is established should not prohibit the ability of the emergency roof escape system to incorporate ventilation capability as an option."

The agency is not aware of any language in the proposed standard that would have prohibited the use of combination roof exit/vent units. Also, the agency does not believe that there is any need to create unique specifications for such combination units. A combination exit vent should meet the same requirements as a dedicated roof emergency exit.

14. Roof Exit Release Mechanisms

The NPRM proposed that roof exits shall have "a single locking mechanism which locks and unlocks the roof exit with a single force application not greater than 40 pounds." A number of commenters objected to the single force application requirement based on safety concerns.

Blue Bird noted that it had examined roof exit designs which incorporated a single force application device for unlatching the exit. Blue Bird commented that "the proposed wording would allow and possibly encourage roof exit latch design that could function like crash-bars on auditorium doors. Latches that actuate by being pushed in the direction of the initial push-out motion of the exit could be knocked open unintentionally in a rollover accident and occupant ejection could result."

Thomas Built also requested a roof exit release mechanism that is "similar to the rear push-out window release requirement. Namely, that the roof exit be releasable by not more than two mechanisms which do not have to be operated simultaneously."

Transpec said that single force release mechanisms "should not be used in vehicles where passengers can be thrown against them and ejected accidently." Accordingly, Transpec suggested a "double action" release mechanism for roof exits rather than the proposed "single action" release mechanism.

Finally, Oregon expressed its belief that a double action latch for roof exits would be safer than the single action latch that was proposed.

The agency agrees with the above comments and is concerned about the potential for ejection in a rollover if a single release mechanism is allowed that will allow the roof exit to open upon the application of force in the direction the roof exit opens. Accordingly, the final regulatory language adopts language similar to the existing Standard No. 217 requirements for rear push-out windows. Specifically, not more than two release mechanisms can be used. The mechanism or, if two mechanisms are used, each mechanism, shall require either one or two force applications to open. At least one of these force applications

must differ from the direction of the initial push-out motion by no less than 90 degrees and no more than 180 degrees.

15. Wheelchair Lifts

Thomas Built Buses commented that many school buses are equipped for wheelchair passengers, including the installation of a wheelchair lift. It suggested that NHTSA "allow replacement of one emergency door with a wheelchair lift door if the bus is equipped with at least one wheelchair placement."

There are two types of wheelchair lifts: passive and active. Passive lifts are devices which are normally located in an existing doorway used both by persons with disabilities and those without disabilities. When stowed, a passive lift allows persons without disabilities the unimpeded use of the door in which the lift is located. By contrast, active lifts are devices that require a separate opening in the bus body and which impede the use of that opening when stowed.

The agency believes that doorways incorporating active lifts should be reserved for wheelchair-bound or other disabled children who cannot easily use other exits on the bus. Additionally, the agency notes that, if the bus driver is not available, it may not be as easy for a child to operate an active lift to open the doorway, as it is for a child to operate other emergency exit mechanisms. Also, since active lifts take time to operate, they may not provide a sufficiently fast means of emergency exit for a child without disabilities.

Based on the above, the agency has concluded that door openings that contain a passive lift equipment can be used to fulfill the minimum emergency exit requirements. However, openings for active lifts cannot.

16. Title of Standard

The NPRM proposed to change the name of Standard No. 217 to reflect more accurately the scope and purpose of the standard. Only NSTA and Washington commented on the proposal, and both agreed with the change. Accordingly, the final rule establishes a new title for Standard No. 217, *Bus Emergency Exits and Window Retention and Release*.

17. Leadtime

The NPRM proposed an 18-month leadtime for the effective date of any new school bus emergency exit requirements. Because of its concerns about structural fatigue from additional side emergency exit doors, Thomas Built requested a two-year leadtime. Blue Bird stated that the proposed 18-month lead time is adequate "providing no new or unusual requirements are incorporated in the final rule that are significantly different from the proposals." Also, Blue Bird asserted that the agency would need "to respond to requests for interpretations or clarifications in a timely manner and to make available associated test procedures and references in a timely manner" if the 18-month leadtime is to be acceptable.

Given the agency's conclusion that the Thomas Built concerns over structural fatigue due to side emergency exit doors are not significant (See Section 2, Option A, Emergency Exit Doors, or Option B, Doors and Roof Hatches), and the fact that no more than two additional side emergency exit doors would ever have to be installed on a bus, the agency has concluded that an 18-month leadtime is adequate.

This final rule does not have any retroactive effect. Under section 103(d) of the National Traffic and Motor Vehicle Safety Act (Safety Act; 15 U.S.C. 1392(d)), whenever a Federal motor vehicle safety standard is in effect, a state may not adopt or maintain a safety standard applicable to the same aspect of performance which is not identical to the Federal standard, except to the extent that the state requirement imposes a higher level of performance and applies only to vehicles procured for the State's use. Section 105 of the Safety Act (15 U.S.C. 1394) sets forth a procedure for judicial review of final rules establishing, amending or revoking Federal motor vehicle safety standards. That section does not require submission of a petition for reconsideration or other administrative proceedings before parties may file suit in court.

(**Note:** For the convenience of the reader, the preamble uses U.S. units of weights and measurements since these units were used in the NPRM. However, pursuant to E.O. 12770 (56 F.R. 35801; July 29, 1991), the agency is in the process of converting all safety standards to metric units. Therefore, metric equivalents, rounded to the nearest whole unit, are used in the regulatory text of this notice will be used throughout future Standard No. 217 notices.)

In consideration of the foregoing, 49 CFR 571.217 is amended as follows:

The title of Standard No. 217, *Bus Window Retention and Release,* (49 CFR 571.217) is revised to read as follows:

§ 571.217 Standard No. 217, Bus Emergency Exits and Window Retention and Release.

Paragraph S4 of Standard No. 217 is amended by adding the following definitions in alphabetical order:

Daylight opening means the maximum unobstructed opening of an emergency exit when viewed from a direction perpendicular to the plane of the opening.

Mid-point of the passenger compartment means any point on a vertical transverse plane bisecting the vehicle longitudinal centerline that extends between the two vertical transverse planes which define the foremost and rearmost limits of the passenger compartment.

Passenger compartment means space within the school bus interior that is between a vertical transverse plane located 76 centimeters in front of the forwardmost passenger seating reference point and a vertical transverse plane tangent to the rear interior wall of the bus at the vehicle centerline.

Post and roof bow panel space means the area between two adjacent post and roof bows.

4. Paragraph S5.2.3 of Standard No. 217 is revised to read as follows:

S5.2.3 *School buses.* Each school bus shall comply with S5.2.3.1 through S5.2.3.3.

S5.2.3.1 Each bus shall be equipped with the exits specified in either S5.2.3.1(a) or S5.2.3.1(b), chosen at the option of the manufacturer. The area in square centimeters of the unobstructed openings for emergency exit shall collectively amount to at least 170 times the number of designated seating positions in the bus. The amount of emergency exit area credited to an emergency exit is based on the daylight opening of the exit opening.

(a)(1) One rear emergency door that opens outward and is hinged on the right side (either side in the case of a bus with a GVWR of 4,536 kilograms or less), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA = [TA − FSDA − RDEA]

Where:

TA (total area) = 170 × number of designated seating positions;

FSDA (front service door area) = size of the available front service door opening; and

RDEA (rear door exit area) = size of the available rear emergency exit door opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs (a)(2) (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A left side emergency exit door that meets the requirements of S5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meet the requirements of S5.2.3.2(c), at the option of the manufacturer.

(b)(1) One emergency door on the vehicle's left side that is hinged on its forward side and meets the requirements of S5.2.3.2(a), and a push-out rear window that provides a minimum opening clearance 41 centimeters high and 122 centimeters wide and meets the requirements of S5.2.3.2(c), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=[TA—FSDA—SDEA—POWA]

Where:

TA (total area) = 170 × number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening;

SDEA (side door exit area)=size of the available side emergency exit door opening; and

POWA (push-out window area)=size of the available rear emergency push-out window opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs

(b)(2) (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A right side emergency exit door that meets the requirements of S5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meets the requirements of S5.2.3.2(c), at the option of the manufacturer.

(c) The area of an opening equipped with a wheelchair lift is counted toward meeting the AEEA requirement under paragraph (a) or (b) of this section only if the lift is of a design which allows it to be folded or stowed in such a manner that the area is available for use by persons not needing the lift. The daylight opening of such an exit is calculated with the lift in the folded or stowed position.

S5.2.3.2 All emergency exits required by S5.2.3.1(a) and S5.2.3.1(b) shall meet the following criteria:

(a) *Side emergency exit doors.*

(1) Each side emergency exit door shall be hinged on its forward side.

(2) A side emergency exit door installed pursuant to S5.2.3.1(a)(2)(i) shall be located on the left side of the bus and as near as practicable to the midpoint of the passenger compartment. A single side emergency exit door installed pursuant to S5.2.3.1(a)(2)(iii) shall be located on the right side of the bus. In the case of a bus equipped with two emergency door exits pursuant to S5.2.3.1(a)(2)(iii), the first shall be located on the right side and the second on the left side of the bus.

(3) A side emergency exit door installed pursuant to S5.2.3.1(b)(2)(i) shall be located on the right side of the bus. A single side emergency exit door installed pursuant to S5.2.3.1(b)(2)(iii) shall be located on the left side of the bus. In the case of a bus equipped with two emergency door exits pursuant to S5.2.3.1(b)(2)(iii), the first shall be located on the left side and the second on the right side of the bus.

(4) No two side emergency exit doors shall be located, in whole or in part, within the same post and roof bow panel space.

(b) *Emergency roof exit.* (1) Each emergency roof exit shall be hinged on its forward side, and shall be operable from both inside and outside the vehicle.

(2) In a bus equipped with a single emergency roof exit, the exit shall be located as near as practicable to the midpoint of the passenger compartment.

(3) In a bus equipped with two emergency roof exits, one shall be located as near as practicable to a point equidistant between the midpoint of the passenger compartment and the foremost limit of the passenger compartment and the other shall be located as near as practicable to a point equidistant between the midpoint of the passenger compartment and the rearmost point of the passenger compartment.

(4) In a bus equipped with three or more emergency roof exits, the roof exits shall be installed so that, to the extent practicable, the longitudinal distance between each pair of adjacent roof exits is the same and equal to the distance from the foremost point of the passenger compartment to the foremost roof exit and to the distance from the rearmost point of that compartment to the rearmost roof exit.

(5) Except as provided in paragraph (b)(6) of this section, each emergency roof exit shall be installed with its longitudinal centerline coinciding with a longitudinal vertical plane passing through the longitudinal centerline of the school bus.

(6) In a bus equipped with two or more emergency roof exits, for each roof exit offset from the longitudinal vertical plane specified in paragraph (b)(5) of this section, there shall be another roof exit offset from that plane an equal distance to the other side.

(c) *Emergency exit windows.* A bus equipped with emergency exit windows shall have an even number of such windows, not counting a push-out rear window required by S5.2.3.1(b). Any side emergency exit windows shall be evenly divided between the right and left sides of the bus.

S5.2.3.3 The engine starting system of a bus shall not operate if any emergency exit is locked from either inside or outside the bus. For purposes of this requirement, "locked" means that the release mechanism cannot be activated and the exit opened by a person at the exit without a special device such as a key or special information such as a combination.

5. Paragraph S5.3.3 is revised to read as follows:

S5.3.3 School bus emergency exit release.

S5.3.3.1 When tested under the conditions of S6, both before and after the window retention test required by S5.1, each school bus emergency exit door shall allow manual release of the door by a single person, from both inside and outside the passenger compartment, using a force application that conforms to paragraphs (a) through (c), except a school bus with a GVWR of 4,536 kilograms or less does not have to conform to paragraph (a). The release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of that emergency exit door.

(a) *Location:* Within the high force access region shown in figure 3A for a side emergency exit door, and in figure 3D for a rear emergency exit door.

(b) *Type of motion:* Upward from inside the bus; at the discretion of the manufacturer from outside the bus. Buses with a GVWR of 4,536 kilograms or less shall provide interior release mechanisms that operate by either an upward or pull-type motion. The pull-type motion shall be used only when the release mechanism is recessed in such a manner that the handle, lever, or other activating device, before being pulled, does not protrude beyond the rim of the recessed receptacle.

(c) *Magnitude of force:* Not more than 178 newtons.

S5.3.3.2 When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency exit window shall allow manual release of the exit by a single person, from inside the passenger compartment, using not more than two release mechanisms located in specified low-force or high-force regions (at the option of the manufacturer) with force applications and types of motions that conform to either paragraph (a) or (b). In the case of windows with one release mechanism, the mechanism shall require two force applications to open. In the case of windows with two release mechanisms, each mechanism shall require either one or two force applications to open. At least one of these force applications for each window shall differ from the direction of the initial push-out motion of the exit by no less than 90° and no more than 180°. Each release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When the release mechanism is open and the vehicle's ignition is in the "on" position, a continuous warning shall be audible at the driver's seating position and in the vicinity of that emergency exit.

(a) Emergency exit windows—Low-force application.

(1) *Location:* Within the low-force access regions shown in Figures 1 and 3 for an emergency exit window.

(2) *Type of motion:* Rotary or straight.

(3) *Magnitude:* Not more than 89 newtons.

(b) Emergency exit windows—High-force application.

(1) *Location:* Within the high-force access regions shown in Figures 2 and 3 for an emergency exit window.

(2) *Type of motion:* Straight and perpendicular to the undisturbed exit surface.

(3) *Magnitude:* Not more than 178 newtons.

S5.3.3.3 When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency roof exit shall allow manual release of the exit by a single person, from both inside and outside the passenger compartment, using not more than two release mechanisms located in specified low-force or high-force regions (at the option of the manufacturer) with force applications and types of motions that conform to either paragraph (a) or (b). In the case of roof exits with one release mechanism, the mechanism shall require two force applications to open. In the case of roof exits with two release mechanisms, each mechanism shall require either one or two force applications to open. At least one of these force applications for each roof exit shall differ from the direction of the initial push-out motion of the exit by no less than 90° and no more than 180°.

(a) Emergency roof exits—Low-force application.

(1) *Location:* Within the low-force access regions shown in Figure 3B, in the case of buses whose roof exits are not offset from the plane specified in S5.2.3.2(b)(5). In the case of buses which have roof exits offset from the plane specified in S5.2.3.2(b)(5), the amount of offset shall be used to recalculate the dimensions in Figure 3B for the offset exits.

(2) *Type of motion:* Rotary or straight.

(3) *Magnitude:* Not more than 89 newtons.

(b) Emergency roof exits—High-force application.

(1) *Location:* Within the high-force access regions shown in Figure 3B, in the case of buses whose roof exits are not offset from the plane specified in S5.2.3.2(b)(5). In the case of buses which have roof exits offset from the plane specified in S5.2.3.2(b)(5), the amount of offset shall be used to recalculate the dimensions in Figure 3B for the offset exits.

(2) *Type of motion:* Straight and perpendicular to the undisturbed exit surface.

(3) *Magnitude:* Not more than 178 newtons.

6. Paragraph S5.4.2.1 is revised to read as follows:

S5.4.2.1 *School buses with a GVWR of more than 4,536 kilograms.*

(a) *Emergency exit doors.* After the release mechanism has been operated, each emergency exit door of a school bus shall, under the conditions of S6., before and after the window retention test required by S5.1, using the force levels specified in S5.3.3, be manually extendable by a single person to a position that permits:

(1) In the case of a rear emergency exit door, an opening large enough to permit unobstructed passage of a rectangular parallelepiped 114 centimeters high, 61 centimeters wide, and 30 centimeters deep, keeping the 114 centimeter dimension vertical, the 61 centimeter dimension parallel to the opening, and the lower surface in contact with the floor of the bus at all times; and

(2) In the case of a side emergency exit door, an opening at least 114 centimeters high and 61 centimeters wide.

(i) Except as provided in paragraph (a)(2)(ii) of this section, no portion of a seat or a restraining barrier shall be installed within the area bounded by the opening of a side emergency exit door, a vertical transverse plane tangent to the rearward edge of the door opening frame, a vertical transverse plane parallel to that plane at a distance of 30 centimeters forward of that plane, and a longitudinal vertical plane passing through the longitudinal centerline of the bus. (See Figure 5A.)

(ii) A seat bottom may be located within the area described in paragraph (a)(2)(i) of this section if the seat bottom pivots and automatically assumes and retains a vertical position when not in use, so that no portion of the seat bottom is within the area described in paragraph (i) when the seat bottom is vertical. (See Figure 5B.)

(iii) No portion of a seat or restraining barrier located forward of the area described in paragraph (a)(2)(i) of this section and between the door opening and a longitudinal vertical plane passing through the longitudinal centerline of the bus shall extend rearward of a vertical transverse plane tangent to the forwardmost portion of a latch mechanism on the door. (See Figures 5B and 5C.)

(3)(i) Each emergency exit door of a school bus shall be equipped with a positive door opening device that, after the release mechanism has been operated, under the conditions of S6, before and after the window retention test required by S5.1—

(A) Bears the weight of the door;

(B) Keeps the door from closing past the point at which the door is perpendicular to the side of the bus body, regardless of the body's orientation; and

(C) Provides a means for release or override.

(ii) The positive door opening device shall perform the functions specified in paragraphs (a)(3)(i) (A) and (B) of this section without the need for additional action beyond opening the door past the point at which the door is perpendicular to the side of the bus body.

(b) *Emergency roof exits.* After the release mechanism has been operated, each emergency roof exit of a school bus shall, under the conditions of S6, before and after the window retention test required by S5.1, using the force levels specified in S5.3.3, be manually extendable by a single person to a position that permits an opening at least 41 centimeters high and 41 centimeters wide.

7. Paragraph S5.5.32 is revised to read as follows:

S5.5.3 *School bus.*

(a) Each school bus emergency exit provided in accordance with S5.2.3.1 shall have the designation "Emergency Door" or "Emergency Exit," as appropriate, in letters at least 5 centimeters high, of a color that contrasts with its background. For emergency exit doors, the designation shall be located at the top of, or directly above, the emergency exit door on both the inside and outside surfaces of the bus. The designation for roof exits shall be located on an inside surface of the exit, or within 30 centimeters of the roof exit opening. For emergency window exits, the designation shall be located at the top of, or directly above, or at the bottom of the emergency window exit on both the inside and outside surfaces of the bus.

(b) Concise operating instructions describing the motions necessary to unlatch and open the emergency exit shall be located within 15 centimeters of the release mechanism on the inside surface of the bus. These instructions shall be in letters at least 1 centimeter high and of a color that contrasts with its background.

Example:

(1) Lift to Unlatch, Push to Open

(2) Turn Handle, Push Out to Open

(c) Each opening for a required emergency exit shall be outlined around its outside perimeter with a minimum 3 centimeters wide retroreflective tape, either red, white, or yellow in color, that, when tested under the conditions specified in S6.1 of 571.131, meets the criteria specified in Table 1.

Issued on October 27, 1992.

Howard M. Smolkin,
Executive Director.

57 F.R. 49413
November 2, 1992

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 217

Bus Emergency Exits and Window Retention and Release

(Docket No. 88–21; Notice 5)

ACTION: Final rule; technical amendment.

SUMMARY: This rule corrects an error made in a November 2, 1992, final rule amending Federal Motor Vehicle Safety Standard No. 217, Bus Emergency Exits and Window Retention and Release. The conversion to metric units of the formula for determining the amount of exit area which must be provided was incorrectly performed. In addition, a table and three figures referred to in the regulatory language of the final rule were omitted.

EFFECTIVE DATE: The amendment made by this rule is effective May 2, 1994.

SUPPLEMENTARY INFORMATION: On November 2, 1992, NHTSA issued a final rule amending Federal Motor Vehicle Safety Standard No. 217, Bus Emergency Exits and Window Retention and Release, to revise the minimum requirements for school bus emergency exits, to improve access to school bus emergency doors, and to improve the visibility of school bus emergency exits.

This notice corrects several errors in that final rule. First, pursuant to E.O. 12770, Metric Usage in Federal Government Programs (56 F.R. 35801; July 29, 1991), the agency is in the process of converting all safety standards to metric units. Therefore, metric equivalents, rounded to the nearest whole unit, were used in the regulatory test of the final rule. However, the formula for determining the amount of exit area which must be provided was incorrectly converted. The notice of proposed rulemaking preceding the recent final rule proposed to require that school buses provide minimum emergency exit spaces which together are equal, in square inches, to 67 times the number of seating positions. This formula was erroneously converted in the final rule to centimeters, not square centimeters. The final rule should have specified that school buses are required to provide minimum emergency exit spaces which together are equal in square centimeters, to 432 times the number of seating position, not 170 times the number of seating positions. (Note: A notice of proposed rulemaking published the same day as the final rule also erroneously used the latter figure (57 FR 49444). If a final rule is issued based on that notice, the correct figure will be used.)

Second, as part of the final rule, S5.4.2.1(a)(2) was amended to specify a zone which must be kept clear to provide access to a side emergency door. The regulatory language refers to three figures, Figure 5A, Figure 5B, and Figure 5C, which illustrate these requirements. These figures were omitted from the copies of the final rule sent to the *Federal Register*. The final rule also amended S5.5.3(c) to require marking of emergency exits with retroreflective tape which meets intensity criteria specified in Table 1. Table 1 was also omitted from the final rule.

This correction imposes no duties or responsibilities on any party not already imposed by the final rule. Discussion in the preamble to the final rule makes it clear that the agency did not intend to change the formula and that the error was merely a conversion error. The figures and table clarify obligations imposed by the final rule. Accordingly, NHTSA finds for good cause that notice and opportunity for comments are necessary.

In consideration of the foregoing, 49 CFR S571.217 is amended as follows:

1. Paragraph S5.2.3.1 of Standard No. 217 is revised to read as follows:

S5.2.3.1 Each bus shall be equipped with the exits specified in either § 5.2.3.1(a) or § 5.2.3.1(b), chosen at the option of the manufacturer. The area in square centimeters of the unobstructed openings for emergency exits shall collectively amount to at least 432 times the number of designated seating positions in the bus. The amount of emergency

exit area credited to an emergency exit is based on the daylight opening of the exit opening.

(a)(1) One rear emergency door that opens outward and is hinged on the right side (either side in the case of a bus with a GVWR of 4.536 kilograms or less), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=[TA-FSDA-RDEA]

Where:

TA (total area)=432 x number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening; and

RDEA (rear door exit area)=size of the available rear emergency exit door opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A left side emergency exit door that meets the requirements of S5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meet the requirements of S5.2.3.2(c), at the option of the manufacturer.

(b)(1) One emergency door on the vehicle's left side that is hinged on its forward side and meets the requirements of S5.2.3.2(a), and a push-out rear window that provides a minimum opening clearance 41 centimeters high and 122 centimeters wide and meets the requirements of S5.2.3.2(c), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=(TA-FSDA-SDEA-POWA)

Where:

TA (total area)=432 x number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening;

SDEA (side door exit area)=size of the available side emergency exit door opening; and

POWA (push-out window area)=size of the available rear emergency push-out window opening.

(2) These exits installed to provide the AEEA shall be of the types specified in paragraphs (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A right side emergency exit door that meets the requirements of § 5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

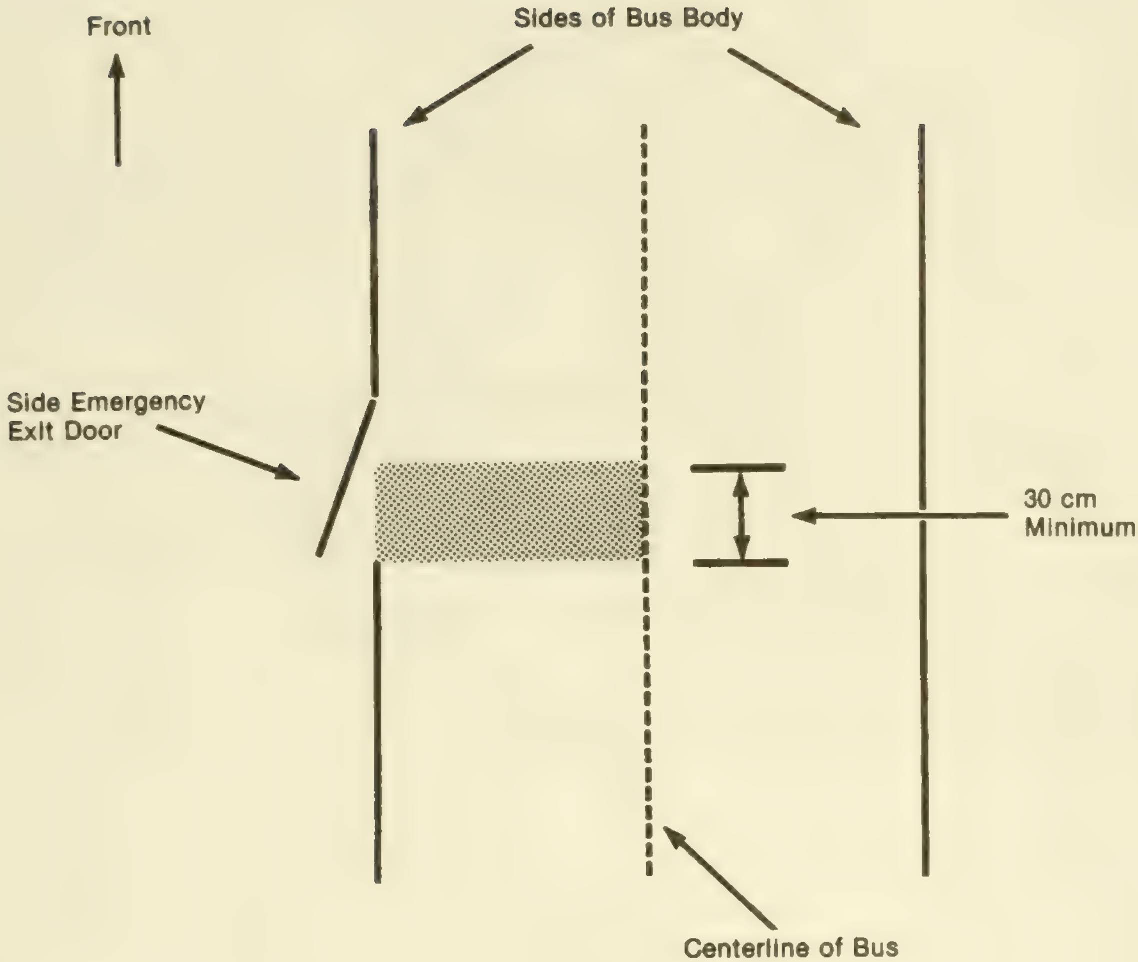
(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meet the requirements of S5.2.3.2(c), at the option of the manufacturer.

(c) The area of an opening equipped with a wheelchair lift is counted toward meeting the AEEA requirement under paragraph (a) or (b) of this section only if the lift is of a design that allows it to be folded or stowed in such a manner that the area is available for use by persons not needing the lift. The daylight opening of such an exit is calculated with the lift in the folder or stowed position.

2. New Figures 5A, 5B, and 5C are added, to appear following Figure 4 at the end of S571.217, as follows:

3. New Table 1 is added, to appear following Figure 5C at the end of S571.217, as follows:

Issued on: November 24, 1992.



Front
Sides of Bus Body
Side Emergency
Exit Door
30 cm
Minimum
Centerline of Bus

Figure 5A

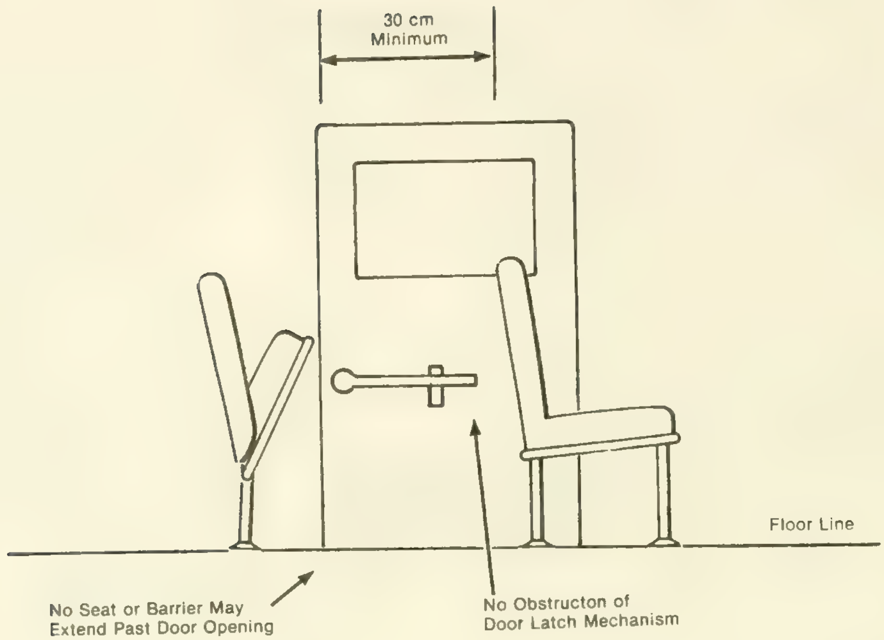


Figure 5B

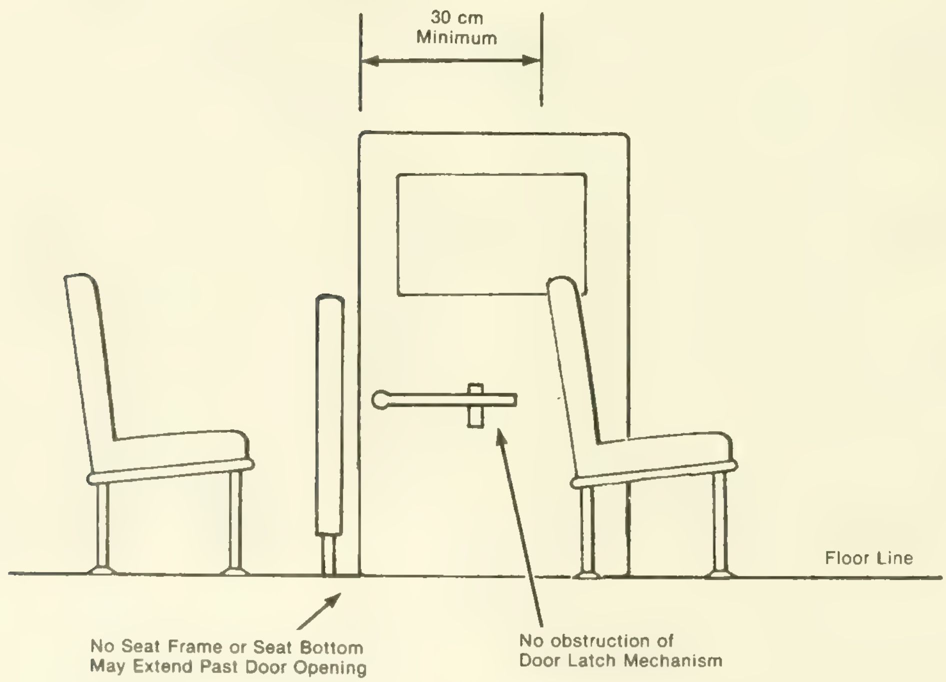


Figure 5C

Table 1. Minimum Specific Intensity Per Unit Area (SIA)

(Candelas per Footcandle Per Square Foot)

Type III Retroreflective Material

A—Glass Bead Retroreflective Element Material

Observation Angle (°)	Entrance Angle (°)	White	Red	Yellow
0.2	-4	250	45	170
0.2	+30	150	25	100
0.5	-4	95	15	62
0.5	+30	65	10	45

B—Prismatic Retroreflective Element Material

Observation Angle (°)	Entrance Angle (°)	White	Red	Yellow
0.2	-4	250	45	170
0.2	+30	95	13.3	64
0.5	-4	200	28	136
0.5	+30	65	10	45

Marion C. Blakey,
Administrator

57 F.R. 57020
December 2, 1992

MOTOR VEHICLE SAFETY STANDARD NO. 217
Bus Window Retention and Release
[Bus Emergency Exits and Window Retention and Release]*

S1. Scope. This standard establishes requirements for the retention of windows other than windshields in buses, and establishes operating forces, opening dimensions, and markings for push-out bus windows and other emergency exits.

S2. Purpose. The purpose of this standard is to minimize the likelihood of occupants being thrown from the bus and to provide a means of readily accessible emergency egress.

S3. Application. This standard applies to buses, except buses manufactured for the purpose of transporting persons under physical restraint.

S4. Definitions.

Adjacent seat means a designated seating position located so that some portion of its occupant space is not more than 10 inches from an emergency exit, for a distance of at least 15 inches measured horizontally and parallel to the exist.

[*Daylight opening means the maximum unobstructed opening of an emergency exit when viewed from a direction perpendicular to the plane of the opening.*]

[*Mid-point of the passenger compartment means any point on a vertical transverse plane bisecting the vehicle longitudinal centerline that extends between the two vertical transverse planes which define the foremost and rearmost limits of the passenger compartment.*]

Occupant space means the space directly above the seat and footwell, bounded vertically by the ceiling and horizontally by the normally positioned seat back and the nearest obstruction of occupant motion in the direction the seat faces.

[*Passenger compartment means space within the school bus interior that is between a vertical transverse plane located 76 centimeters in front of the forwardmost passenger seating reference point and a vertical transverse plane tangent to the rear interior wall of the bus at the vertical centerline.*]

[*Post and roof bow panel space means the area between two adjacent post and roof bows.*]

Push-out window means a vehicle window designed to open outward to provide for emergency egress. **[(57 F.R. 49413—November 2, 1992 Effective: May 2, 1994]**

S5. Requirements.

S5.1 Window retention. Except as provided in S5.1.2, each piece of window glazing and each surrounding window frame, when tested in accordance with the procedure in S5.1.1 under the conditions of S6.1 through S6.3, shall be retained by its surrounding structure in a manner that prevents the formation of any opening large enough to admit the passage of a 4-inch diameter sphere under a force, including the weight of the sphere, of 5 pounds until any one of the following events occurs:

(a) A force of 1200 pounds is reached.

(b) At least 80% of the glazing thickness has developed cracks running from the load contact region to the periphery at two or more points, or shattering of the glazing occurs.

(c) The inner surface of the glazing at the center of force application has moved relative to the window frame along a line perpendicular to the undisturbed inner surface, a distance equal to one-half of the square root of the minimum surface dimension measured through the center of the area of the entire sheet of window glazing.

S5.1.1 An increasing force shall be applied to the window glazing through the head form specified in Figure 4, outward and perpendicular to the undisturbed inside surface at the center of the area of each sheet of window glazing, with a head form travel of 2 inches per minute.

S5.1.2 The requirements of this standard do not apply to a window whose minimum surface

dimension measured through the center of its area is less than 8 inches.

S5.2 Provision of emergency exits. Buses other than school buses shall provide unobstructed openings for emergency exit which collectively amount, in total square inches, to at least 67 times the number of designated seating positions on the bus. At least 40 percent of the total required area of unobstructed openings, computed in the above manner, shall be provided on each side of a bus. However, in determining the total unobstructed openings provided by a bus, no emergency exit, regardless of its area, shall be credited with more than 536 square inches of the total area requirement. School buses shall provide openings for emergency exits that conform to S5.2.3.

S5.2.1 Buses with a GVWR of more than 10,000 pounds. Except as provided in S5.2.1.1, buses with a GVWR of more than 10,000 pounds shall meet the unobstructed openings requirements by providing side exits and at least one rear exit that conforms to S5.3 through S5.5. The rear exit shall meet the requirements when the bus is upright and when the bus is overturned on either side, with the occupant standing facing the exit. When the bus configuration precludes installation of an accessible rear exit, a roof exit that meets the requirements of S5.3 through S5.5 when the bus is overturned on either side, with the occupant standing facing the exit, shall be provided in the rear half of the bus.

S5.2.1.1 A bus with GVWR of more than 10,000 pounds may satisfy the unobstructed openings requirement by providing at least one side door for each three passenger seating positions in the vehicle.

S5.2.2 Buses with a GVWR of 10,000 pounds or less. Buses with a GVWR of 10,000 pounds or less may meet the unobstructed openings requirement by providing:

(a) Devices that meet the requirements of S5.3 through S5.5 without using remote controls or central power systems;

(b) Windows that can be opened manually to a position that provides an opening large enough to admit unobstructed passage, keeping a major axis horizontal at all times, of an ellipsoid generated by rotating about its minor axis an ellipse having a major axis of 20 inches and a minor axis of 13 inches; or

(c) Doors.

S5.2.3 School buses.

S5.2.3.1 [*Each bus shall be equipped with the exits specified in either §5.2.3.1(a) or §5.2.3.1(b), chosen at the option of the manufacturer. The area in square centimeters of the unobstructed openings for emergency exit shall collectively amount to at least 432 times the number of designated seating positions in the bus. The amount of emergency exit area credited to an emergency exit is based on the daylight opening of the exit opening.*

(a)(1) One rear emergency door that opens outward and is hinged on the right side (either side in the case of a bus with a GVWR of 4.536 kilograms or less), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEER=[TA-FSDA-RDEA]

Where:

TA (total area)=432 x number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening; and

RDEA (rear door exit area)=size of the available rear emergency exit door opening.

(2)The exits installed to provide the AEEA shall be of the types specified in paragraphs (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i)A left side emergency exit door that meets the requirements of §5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of §5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of §5.2.3.2(a), emergency roof exits that meet the requirements of §5.2.3.2(b), or emergency window exits that meet the requirements of §5.2.3.2(c), at the option of the manufacturer.

(b)(1) One emergency door on the vehicle's left side that is hinged on its forward side and meets the requirements of §5.2.3.2(a), and a push-out rear window that provides a minimum opening clearance 41 centimeters high and 122 centimeters wide and meets the requirements of

§ 5.2.3.2(c), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=(TA-FSDA-SDEA-POWA)

Where:

TA (total area)=432 x number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening;

SDEA (side door exit area)=size of the available side emergency exit door opening; and

POWA (push-out window area)=size of the available rear emergency push-out window opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A right side emergency exit door that meets the requirements of § 5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of § 5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of § 5.2.3.2(a), emergency roof exits that meet the requirements of § 5.2.3.2(b), or emergency window exits that meet the requirements of § 5.2.3.2(c), at the option of the manufacturer.

(c) The area of an opening equipped with a wheelchair lift is counted toward meeting the AEEA requirement under paragraph (a) or (b) of this section only if the lift is of a design that allows it to be folded or stowed in such a manner that the area is available for use by persons not needing the lift. The daylight opening of such an exit is calculated with the lift in the folder or stowed position. **(57 F.R. 57020—December 2, 1992, Effective: May 2, 1994)]**

S5.2.3.2 The engine starting system of a school bus shall not operate if any emergency door is locked from either inside or outside the bus. For purposes of this requirement, ''locked'' means that the release mechanism cannot be activated by a person at the door without a special device such as a key or special information such as a combination.

S5.3 Emergency exit release.

S5.3.1 Each push-out window or other emergency exit not required by S5.2.3 shall be releasable by operating one or two mechanisms located within the regions specified in Figures 1, 2, and 3. The lower edge of the region in Figure 1 and Region B in Figure 2, shall be located 5 inches above the adjacent seat, or 2 inches above the armrest, if any, whichever is higher.

S5.3.2 When tested under the conditions of S6, both before and after the window retention test required by S5.1, each emergency exit not required by S5.2.3 shall allow manual release of the exit by a single occupant using force applications each of which conforms, at the option of the manufacturer, either to (a) or (b). The release mechanism or mechanisms shall require for release one or two force applications, at least one of which differs by 90 to 180° from the direction of the initial push-out motion of the emergency exit (outward and perpendicular to the exit surface).

(a) Low-force application.

Location: As shown in Figure 1 or Figure 3.

Type of Motion: Rotary or straight.

Magnitude: Not more than 20 pounds.

(b) High force application.

Location: As shown in Figure 2 or Figure 3.

Type of Motion: Straight, perpendicular to the undisturbed exit surface.

Magnitude: Not more than 60 pounds.

S5.3.3 When tested under the conditions of S6, both before and after the window retention test required by S5.1, each school bus emergency door shall allow manual release of the door by a single person, from both inside and outside the bus passenger compartment, using a force application that conforms to paragraphs (a) through (c) except a school bus with a GVWR of 10,000 pounds or less does not have to conform to paragraph (a). Each release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When the release mechanism is not in the closed position and the vehicle ignition is in the ''on'' position, a continuous warning sound shall be audible at the driver's seating position and in the

vicinity of the emergency door having the unclosed mechanism.

(a) Location: Within the high force access region shown in Figure 3A for a side emergency door, and in Figure 3D for a rear emergency door.

(b) Type of motion: Upward from inside the bus; at the discretion of the manufacturer from outside the bus. Buses with a GVWR of 10,000 pounds or less shall provide interior release mechanisms that operate by either an upward or pull-type motion. The pull-type motion shall be used only when the release mechanism is recessed in such a manner that the handle, lever, or other activating device does not protrude beyond the rim of the recessed receptacle.

(c) Magnitude of force: Not more than 40 pounds.

The present S5.4 is renumbered S5.4.1, and the phrase "Each push-out window or other emergency exit shall, after the release mechanism has been operated," is replaced by the phrase "After the release mechanism has been operated, each push-out window or other emergency exit not required by S5.2.3," at the beginning of the paragraph.

[*S5.2.3 School buses. Each school bus shall comply with S5.2.3.1 through S5.2.3.3.*

S5.2.3.1 Each bus shall be equipped with the exists specified in either S5.2.3.1(a) or S5.2.3.1(b), chosen at the option of the manufacturer. The area in square centimeters of the unobstructed openings for emergency exit shall collectively amount to at least 170 times the number of designated seating positions in the bus. The amount of emergency exit area credited to an emergency exit is based on the daylight opening of the exit opening.

(a)(1) One rear emergency door that opens outward and is hinged on the right side (either side in the case of a bus with a GVWR of 4,536 kilograms or less), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=[TA − FSDA − RDEA]

Where:

TA (total area) = 170 × number of designated seating positions;

FSDA (front service door area) = size of the available front service door opening; and

RDEA (rear door exit area) = size of the available rear emergency exit door opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs (a)(2) (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A left side emergency exit door that meets the requirements of S5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: Side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meet the requirements of S5.2.3.2(c), at the option of the manufacturer.

(b)(1) One emergency door on the vehicle's left side that is hinged on its forward side and meets the requirements of S5.2.3.2(a), and a push-out rear window that provides a minimum opening clearance 41 centimeters high and 122 centimeters wide and meets the requirements of S5.2.3.2(c), and exits providing an additional emergency exit area (AEEA) calculated in accordance with the following formula:

AEEA=[TA − FSDA − SDEA − POWA]

Where:

TA (total area) = 170 × number of designated seating positions;

FSDA (front service door area)=size of the available front service door opening;

SDEA (side door exit area)=size of the available side emergency exit door opening; and

POWA (push-out window area)=size of the available rear emergency push-out window opening.

(2) The exits installed to provide the AEEA shall be of the types specified in paragraphs (b)(2) (i) through (iii) of this section, selected in the sequence specified in those paragraphs—

(i) A right side emergency exit door that meets the requirements of S5.2.3.2(a);

(ii) An emergency roof exit that meets the requirements of S5.2.3.2(b);

(iii) Any of the following types of exits, if necessary to provide the AEEA: side emergency exit doors that meet the requirements of S5.2.3.2(a), emergency roof exits that meet the requirements of S5.2.3.2(b), or emergency window exits that meets the requirements of S5.2.3.2(c), at the option of the manufacturer.

(c) The area of an opening equipped with a wheelchair lift is counted toward meeting the AEEA requirement under paragraph (a) or (b) of this section only if the lift is of a design which allows it to be folded or stowed in such a manner that the area is available for use by persons not needing the lift. The daylight opening of such an exit is calculated with the lift in the folded or stowed position.

S5.2.3.2 *All emergency exits required by S5.2.3.1(a) and S5.2.3.1(b) shall meet the following criteria:*

(a) Side emergency exit doors.

(1) Each side emergency exit door shall be hinged on its forward side.

(2) A side emergency exit door installed pursuant to S5.2.3.1(a)(2)(i) shall be located on the left side of the bus and as near as practicable to the midpoint of the passenger compartment. A single side emergency exit door installed pursuant to S5.2.3.1(a)(2)(iii) shall be located on the right side of the bus. In the case of a bus equipped with two emergency door exits pursuant to S5.2.3.1(a)(2)(iii), the first shall be located on the right side and the second on the left side of the bus.

(3) A side emergency exit door installed pursuant to S5.2.3.1(b)(2)(i) shall be located on the right side of the bus. A single side emergency exit door installed pursuant to S5.2.3.1(b)(2)(iii) shall be located on the left side of the bus. In the case of a bus equipped with two emergency door exits pursuant to S5.2.3.1(b)(2)(iii), the first shall be located on the left side and the second on the right side of the bus.

(4) No two side emergency exit doors shall be located, in whole or in part, within the same post and roof bow panel space.

(b) Emergency roof exit. (1) Each emergency roof exit shall be hinged on its forward side, and shall be operable from both inside and outside the vehicle.

(2) In a bus equipped with a single emergency roof exit, the exit shall be located as near as practicable to the midpoint of the passenger compartment.

(3) In a bus equipped with two emergency roof exits, one shall be located as near as practicable to a point equidistant between the midpoint of the passenger compartment and the foremost limit of the passenger compartment and the other shall be located as near as practicable to a point equidistant between the midpoint of the passenger compartment and the rearmost point of the passenger compartment.

(4) In a bus equipped with three or more emergency roof exits, the roof exits shall be installed so that, to the extent practicable, the longitudinal distance between each pair of adjacent roof exits is the same and equal to the distance from the foremost point of the passenger compartment to the foremost roof exit and to the distance from the rearmost point of that compartment to the rearmost roof exit.

(5) Except as provided in paragraph (b)(6) of this section, each emergency roof exit shall be installed with its longitudinal centerline coinciding with a longitudinal vertical plane passing through the longitudinal centerline of the school bus.

(6) In a bus equipped with two or more emergency roof exits, for each roof exit offset from the longitudinal vertical plane specified in paragraph (b)(5) of this section, there shall be another roof exit offset from that plane an equal distance to the other side.

(c) Emergency exit windows. A bus equipped with emergency exit windows shall have an even number of such windows, not counting a push-out rear window required by S5.2.3.1(b). Any side emergency exit windows shall be evenly divided between the right and left sides of the bus.

S5.2.3.3 *The engine starting system of a bus shall not operate if any emergency exit is locked from either inside or outside the bus. For purposes of this requirement, "locked" means that the release mechanism cannot be activated and the exit opened by a person at the exit without a special device such as a key or special information such as a combination.* **(57 F.R. 49413–November 2, 1992. Effective: May 2, 1994.)]**

[S5.3.3 School bus emergency exit release.

S5.3.3.1 *When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency exit door shall allow manual release of the door by a single person, from both inside and outside the passenger compartment, using a force application that conforms to paragraphs (a) through (c), except a school bus with a GVWR of 4,536 kilo-*

grams or less does not have to conform to paragraph (a). The release mechanism shall operate without the use of remote controls or tools, and notwithstanding any failure of the vehicle's power system. When the release mechanism is not in the position that causes an emergency exit door to be closed and the vehicle's ignition is in the "on" position, a continuous warning sound shall be audible at the driver's seating position and in the vicinity of that emergency exit door.

(a) Location: Within the high force access region shown in Figure 3A for a side emergency exit door, and in figure 3D for a rear emergency exit door.

(b) Type of motion: Upward from inside the bus; at the discretion of the manufacturer from outside the bus. Buses with a GVWR of 4,536 kilograms or less shall provide interior release mechanisms that operate by either an upward or pull-type motion. The pull-type motion shall be used only when the release mechanism is recessed in such a manner that the handle, lever, or other activating device, before being pulled, does not protrude beyond the rim of the recessed receptacle.

(c) Magnitude of force: Not more than 178 newtons.

S5.3.3.2 *When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency exit window shall allow manual release of the exit by a single person, from inside the passenger compartment, using not more than two release mechanisms located in specified low-force or high-force regions (at the option of the manufacturer) with force applications and types of motions that conform to either paragraph (a) or (b). In the case of windows with one release mechanism, the mechanism shall require two force applications to open. In the case of windows with two release mechanisms, each mechanism shall require either one or two force applications to open. at least one of these force applications for each window shall differ from the direction of the initial push-out motion of the exit by no less than 90° and no more than 180°. Each release mechanism shall operate without the use of remote controls or tools, and not withstanding any failure of the vehicle's power system. When the release mechanism is open and the vehicle's ignition is in the "on" position, a continuous warning shall be audible at the driver's seating position and in the vicinity of that emergency exit.*

(a) Emergency exit windows—Low-force application.

(1) Location: Within the low-force access regions shown in Figures 1 and 3 for an emergency exit window.

(2) Type of motion: Rotary or straight.

(3) Magnitude: Not more than 89 newtons.

(b) Emergency exit windows—High-force application.

(1) Location: Within the high-force access regions shown in Figures 2 and 3 for an emergency exit window.

(2) Type of motion: Straight and perpendicular to the undisturbed exit surface.

(3) Magnitude: Not more than 178 newtons.

S5.3.3.3 *When tested under the conditions of S6., both before and after the window retention test required by S5.1, each school bus emergency roof exit shall allow manual release of the exit by a single person, from both inside and outside the passenger compartment, using not more than two release mechanisms located in specified low-force or high-force regions (at the option of the manufacturer) with force applications and types of motions that conform to either paragraph (a) or (b). In the case of roof exits with one release mechanism, the mechanism shall require two force applications to open. In the case of roof exits with two release mechanisms, each mechanism shall require either one or two force applications to open. At least one of these force applications for each roof exit shall differ from the direction of the initial push-out motion of the exit by no less than 90° and no more than 180°.*

(a) Emergency roof exits—Low-force application.

(1) Location: Within the low force access regions shown in Figure 3B, in the case of buses whose roof exits are not offset from the plane specified in S5.2.3.2(b)(5). In the case of buses which have roof exits offset from the plane specified in S5.2.3.2(b)(5), the amount of offset shall be used to recalculate the dimensions in Figure 3B for the offset exits.

(2) Type of motion: Rotary or straight.

(3) Magnitude: Not more than 89 newtons.

(b) Emergency roof exits—High-force application.

(1) Location: Within the high force access regions shown in Figure 3B, in the case of buses whose roof exits are not offset from the plane specified in S5.2.3.2(b)(5). In the case of buses which have roof exits offset from the plane specified in S5.2.3.2(b)(5), the amount of offset shall be used to recalculate the dimensions in Figure 3B for the offset exits.

(2) Type of motion: Straight and perpendicular to the undisturbed exit surface.

(3) Magnitude: Not more than 178 newtons. **(57 FR 49413—November 2, 1992. Effective: May 2, 1994]**

S5.4 Emergency exit extension.

S5.4.1 After the release mechanism has been operated, each push-out window or other emergency exit not required by S5.2.3 shall, under the conditions of S6, before and after the window retention test required by S5.1, using the reach distances and corresponding force levels specified in S5.3.2, be manually extendable by a single occupant to a position that provides an opening large enough to admit unobstructed passage, keeping a major axis horizontal at all times, of an ellipsoid generated by rotating about its minor axis an ellipse having a major axis of 20 inches and a minor axis of 13 inches.

S5.4.2 School bus emergency exit extension.

S5.4.2.1 School bus with a GVWR of more than 10,000 pounds. After the release mechanism has been operated, the emergency door of a school bus with a GVWR of more than 10,000 pounds shall, under the conditions of S6, before and after the window retention test required by S5.1, using the force levels specified in S5.3.3, be manually extendable by a single person to a position that permits—

(a) In the case of rear emergency door, an opening large enough to permit unobstructed passage of a rectangular parallelepiped 45 inches high, 24 inches wide, and 12 inches deep, keeping the 45-inch dimension vertical, the 24-inch dimension parallel to the opening, and the lower surface in contact with the floor of the bus at all times; and

(b) In the case of a side emergency door, an opening at least 45 inches high and 24 inches wide. A vertical transverse plane tangent to the rearmost point of a seat back shall pass through the forward edge of a side emergency door.

[S5.4.2.1 School buses with a GVWR of more than 4,536 kilograms.

(a) Emergency exit doors. After the release mechanism has been operated, each emergency exit door of a school bus shall, under the conditions of S6., before and after the window retention test required by S5.1, using the force levels specified in S5.3.3, be manually extendable by a single person to a position that permits:

(1) In the case of a rear emergency exit door, an opening large enough to permit unobstructed passage of a rectangular parallelepiped 114 centimeters high, 61 centimeters wide, and 30 centimeters deep, keeping the 114 centimeter dimension vertical, the 61 centimeter dimension parallel to the opening, and the lower surface in contact with the floor of the bus at all times; and

(2) In the case of a side emergency exit door, an opening at least 114 centimeters high and 61 centimeters wide.

(i) Except as provided in paragraph (a)(2)(ii) of this section, no portion of a seat or a restraining barrier shall be installed within the area bounded by the opening of a side emergency exit door, a vertical transverse plane tangent to the rearward edge of the door opening frame, a vertical transverse plane parallel to that plane at a distance of 30 centimeters forward of that plane, and a longitudinal vertical plane passing through the longitudinal centerline of the bus. (See Figure 5A).

(ii) A seat bottom may be located within the area described in paragraph (a)(2)(i) of this section if the seat bottom pivots and automatically assumes and retains a vertical position when not in use, so that no portion of the seat bottom is within the area described in paragraph (i) when the seat bottom is vertical. (See Figure 5B).

(iii) No portion of a seat or restraining barrier located forward of the area described in paragraph (a)(2)(i) of this section and between the door opening and a longitudinal vertical plane passing through the longitudinal centerline of the bus shall extend rearward of a vertical transverse plane tangent to the forwardmost portion of a latch mechanism on the door. (See Figures 5B and 5C.)

(3)(i) Each emergency exit door of a school bus shall be equipped with a positive door open-

ing device that, after the release mechanism has been operated, under the conditions of S6, before and after the window retention test required by S5.1—

(A) Bears the weight of the door;

(B) Keeps the door from closing past the point at which the door is perpendicular to the side of the bus body, regardless of the body's orientation; and

(C) Provides a means for release or override.

(ii) The positive door opening device shall perform the functions specified in paragraph (a)(3)(i) (A) and (B) of this section without the need for additional action beyond opening the door past the point at which the door is perpendicular to the side of the bus body.

(b) Emergency roof exits. After the release mechanism has been operated, each emergency roof exit of a school bus shall, under the conditions of S6, before and after the window retention test required by S5.1, using the force levels specified in S5.3.3, be manually extendable by a single person to a position that permits an opening at least 41 centimeters high and 41 centimeters wide. **(57 FR 49413—November 2, 1992. Effective: May 2, 1994)]**

S5.4.2.2 School buses less than 10,000 pounds. A school bus with a GVWR of 10,000 pounds or less shall conform to all the provisions of S5.4.2 except that the parallelepiped dimension for the opening of the rear emergency door or doors shall be 45 inches high, 22 inches wide, and 6 inches deep.

S5.5 Emergency exit identification.

S5.5.1 In buses other than school buses, except for windows serving as emergency exits in accordance with S5.2.2(b) and doors in buses with a GVWR of 10,000 pounds or less, each emergency door shall have the designation "Emergency Door" or "Emergency Exit" and each push-out window or other emergency exit shall have the designation "Emergency Exit" followed by concise operating instructions describing each motion necessary to unlatch and open the exit, located within 6 inches of the release mechanism.

Examples:

(1) Lift to Unlatch Push to Open

(2) Lift Handle and Push out to Open

When a release mechanism is not located within an occupant space of an adjacent seat, a label meeting the requirements of S5.5.2 that indicates the location of the nearest release mechanism shall be placed within the occupant space.

Example: Emergency exit instructions located next to seat ahead.

S5.5.2 In buses other than school buses, except as provided in S5.5.2.1, each marking shall be legible, when the only source of light is the normal night-time illumination of the bus interior, to occupants having corrected visual acuity of 20/40 (Snellen ratio) seated in the adjacent seat, seated in the seat directly adjoining the adjacent seat, and standing in the aisle location that is closest to that adjacent seat. The marking shall be legible from each of these locations when the other two corresponding locations are occupied.

S5.5.2.1 If the exit has no adjacent seat, the marking must meet the legibility requirements of S5.5.2 for occupants standing in the aisle location nearest to the emergency exit, except for a roof exit, which must meet the legibility requirements for occupants positioned with their backs against the floor opposite the roof exit.

S5.5.3 School Bus. Each school bus emergency exit provided in accordance with S5.2.3.1 shall have the designation "Emergency Door" or "Emergency Exit," as appropriate, in letters at least 2 inches high, of a color that contrasts with its background, located at the top of or directly above the emergency exit on both the inside and outside surfaces of the bus. Concise operating instructions describing the motions necessary to unlatch and open the emergency exit, in letters at least three-eighths of an inch high, of a color that

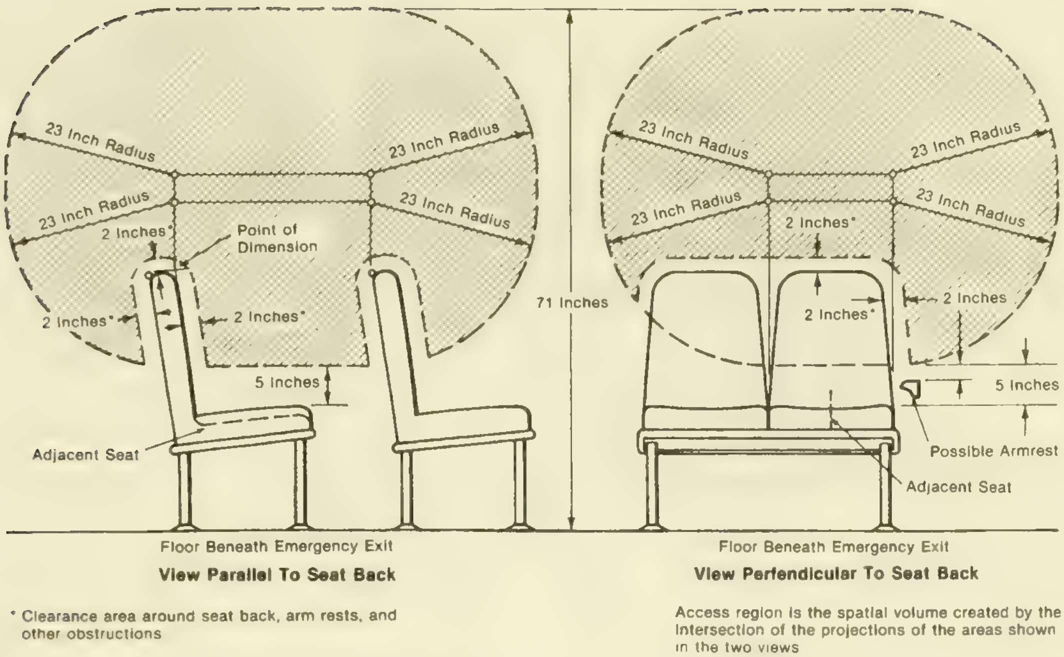


Figure 1.—Low-Force Access Region for Emergency Exits Having Adjacent Seats

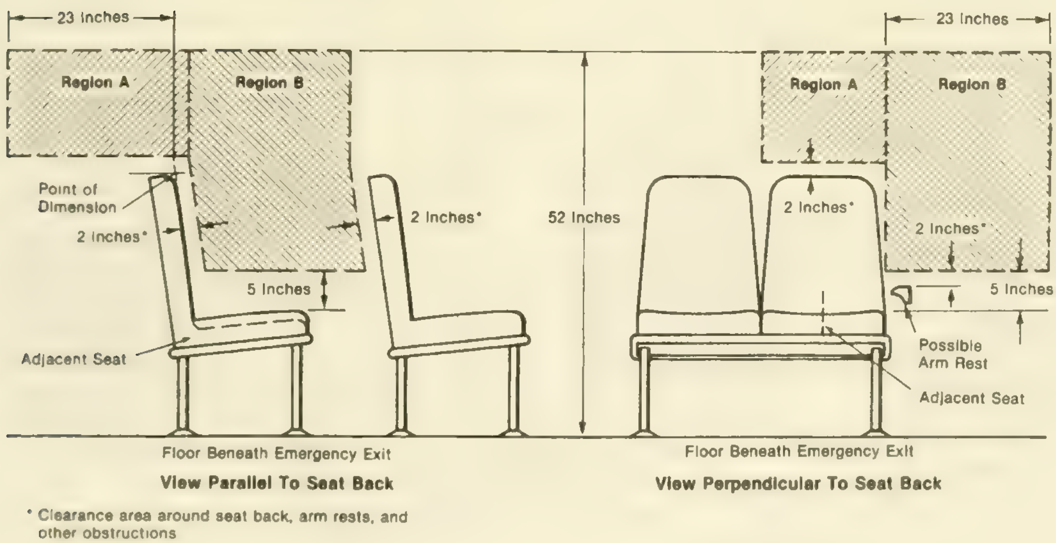


Figure 2.—High-Force Access Regions for Emergency Exits Having Adjacent Seats

LOW- AND HIGH-FORCE ACCESS REGIONS FOR EMERGENCY EXITS WITHOUT ADJACENT SEATS

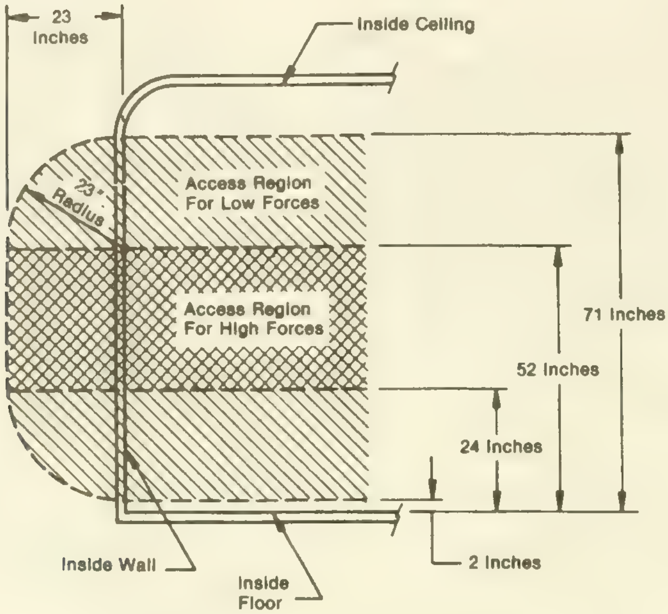


Figure 3A.—Side Emergency Exit

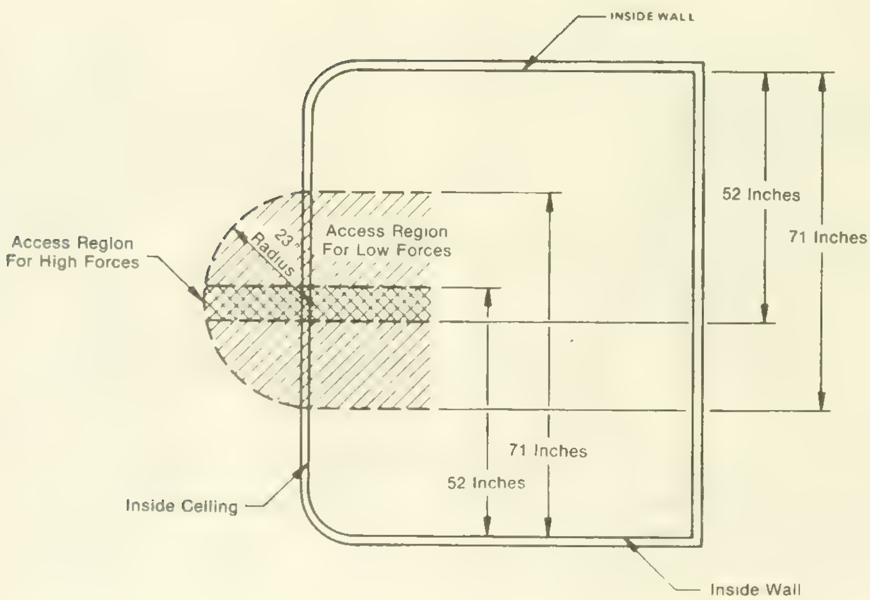
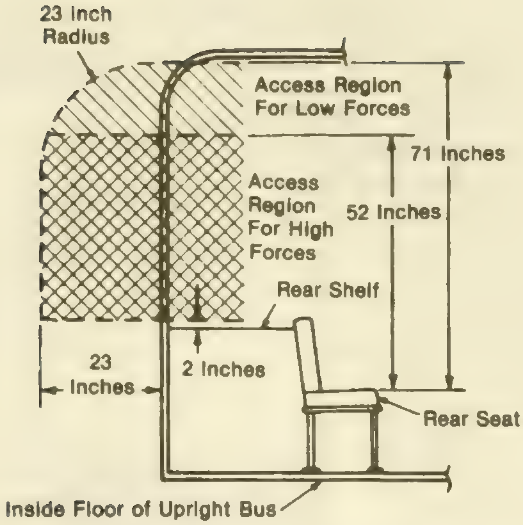


Figure 3B.—Roof Emergency Exit



* Typical clearance around obstructions

Figure 3C.—Rear Emergency Exit With Rear Obstruction

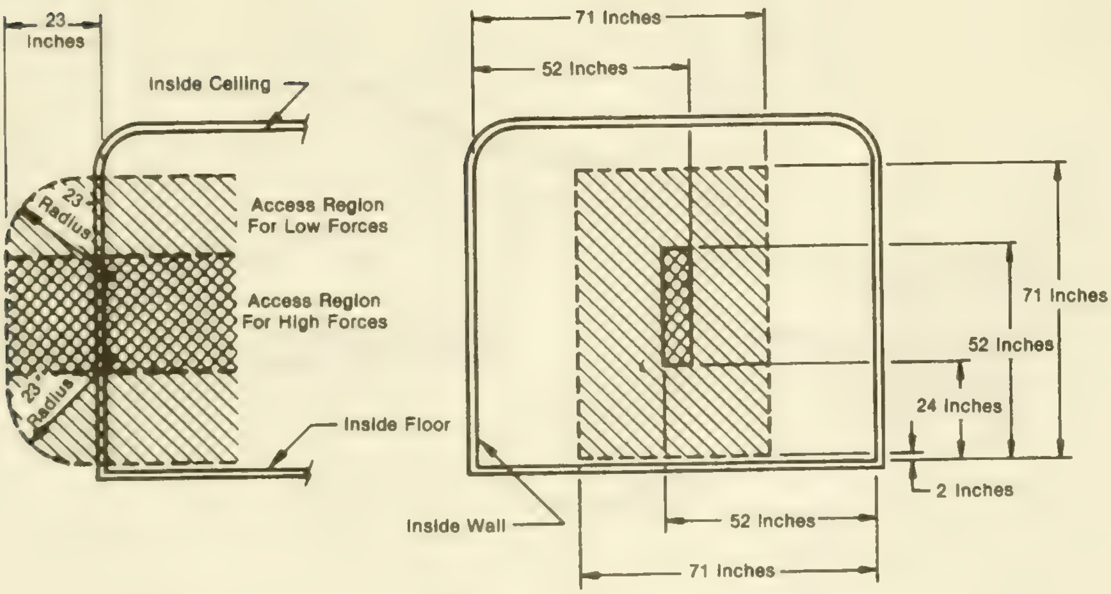
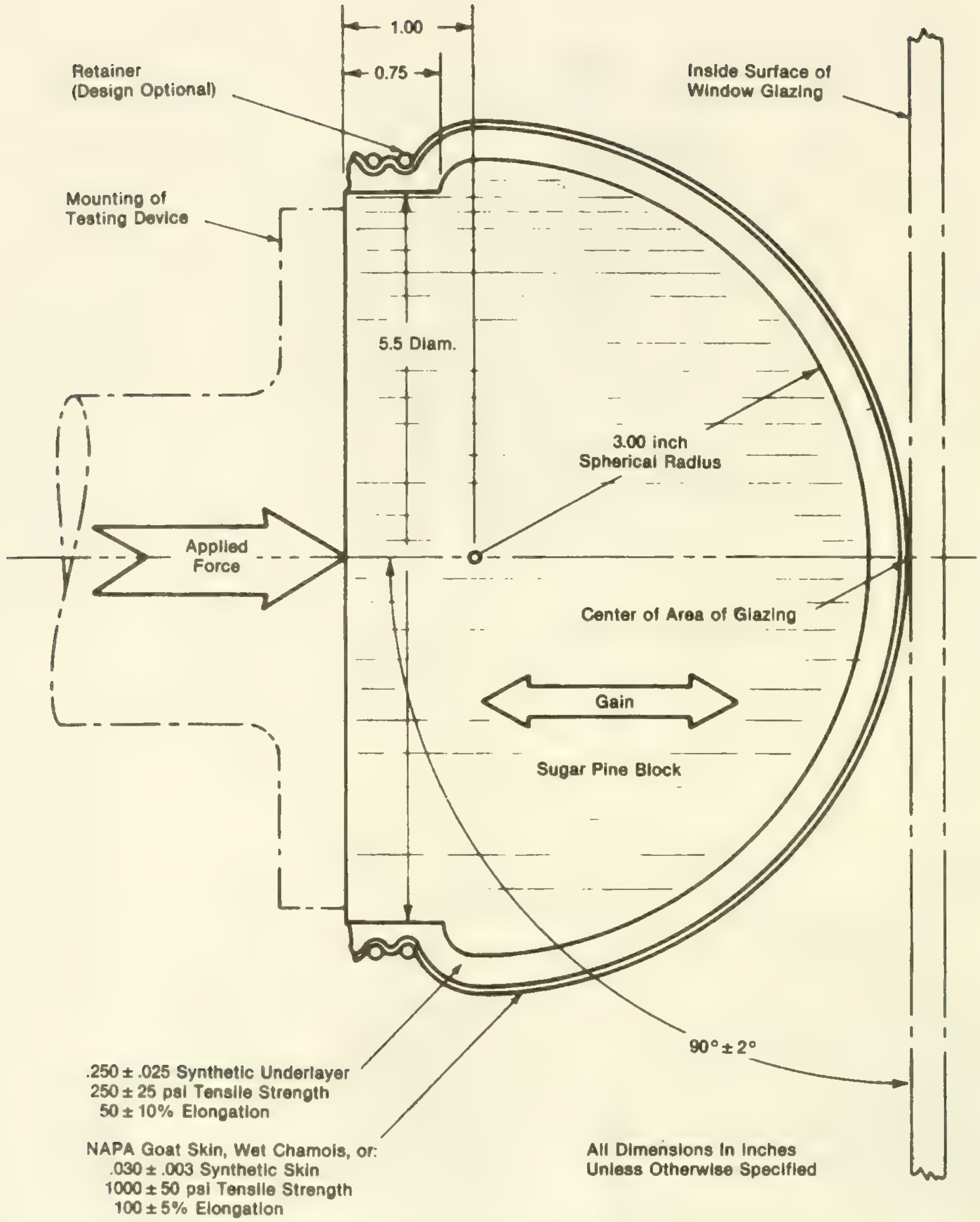
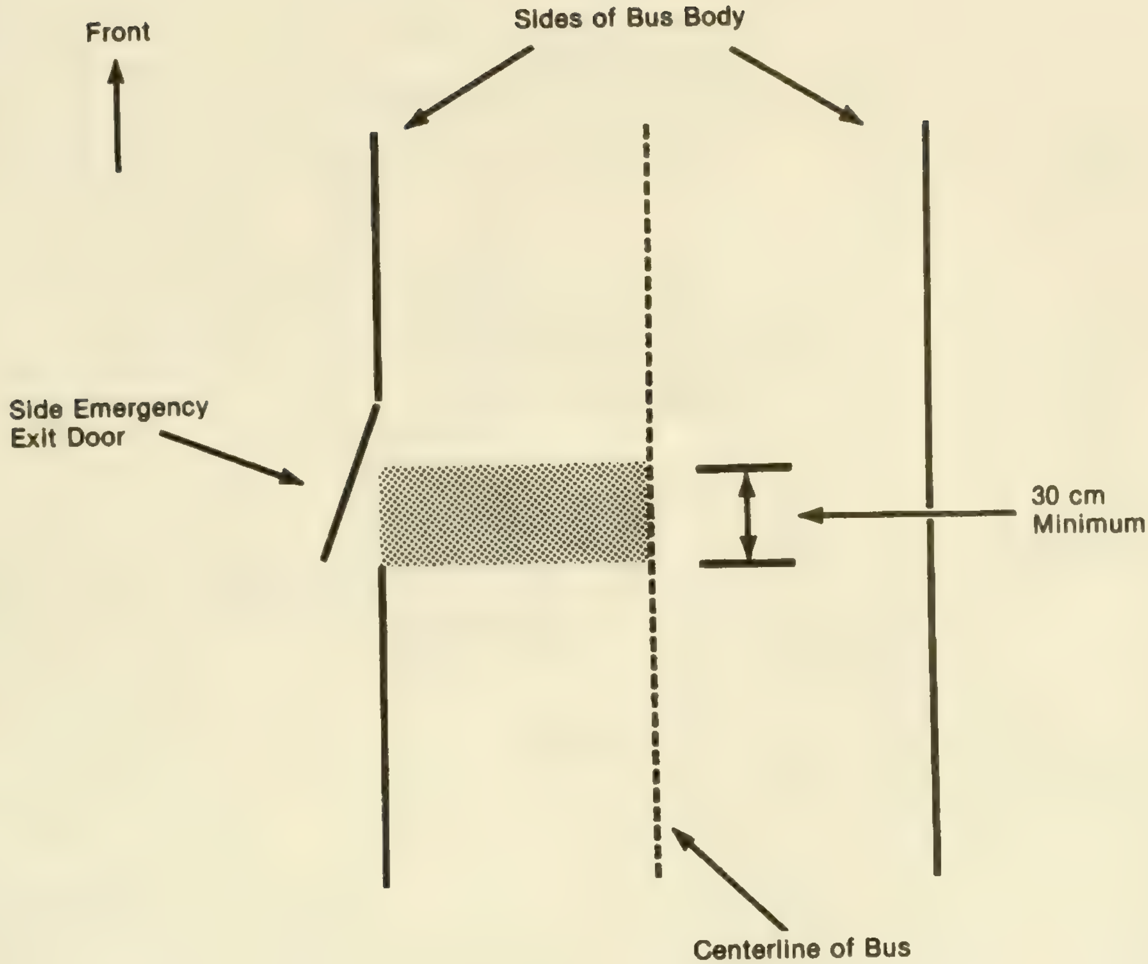


Figure 3D.—Rear Emergency Exit Without Rear Obstruction



1.00
0.75
Retainer
(Design Optional)
Inside Surface of
Window Glazing
Mounting of
Testing Device
5.5 Diam.
3.00 inch
Spherical Radius
Applied
Force
Center of Area of Glazing
Gain
Sugar Pine Block
90° ± 2°
.250 ± .025 Synthetic Underlayer
250 ± 25 psi Tensile Strength
50 ± 10% Elongation
NAPA Goat Skin, Wet Chamois, or:
.030 ± .003 Synthetic Skin
1000 ± 50 psi Tensile Strength
100 ± 5% Elongation
All Dimensions In Inches
Unless Otherwise Specified

Figure 4



Front
Sides of Bus Body
Side Emergency
Exit Door
30 cm
Minimum
Centerline of Bus

Figure 5A

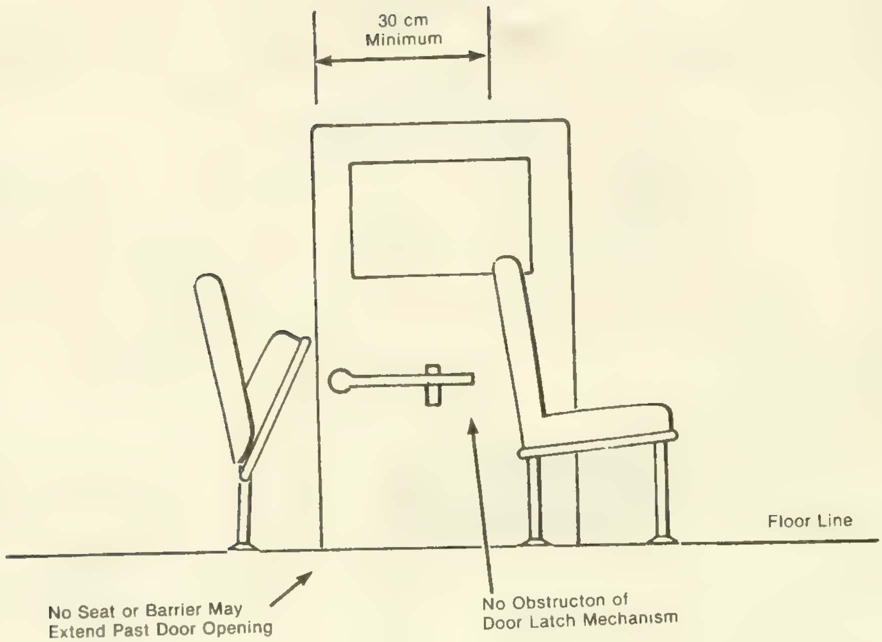


Figure 5B

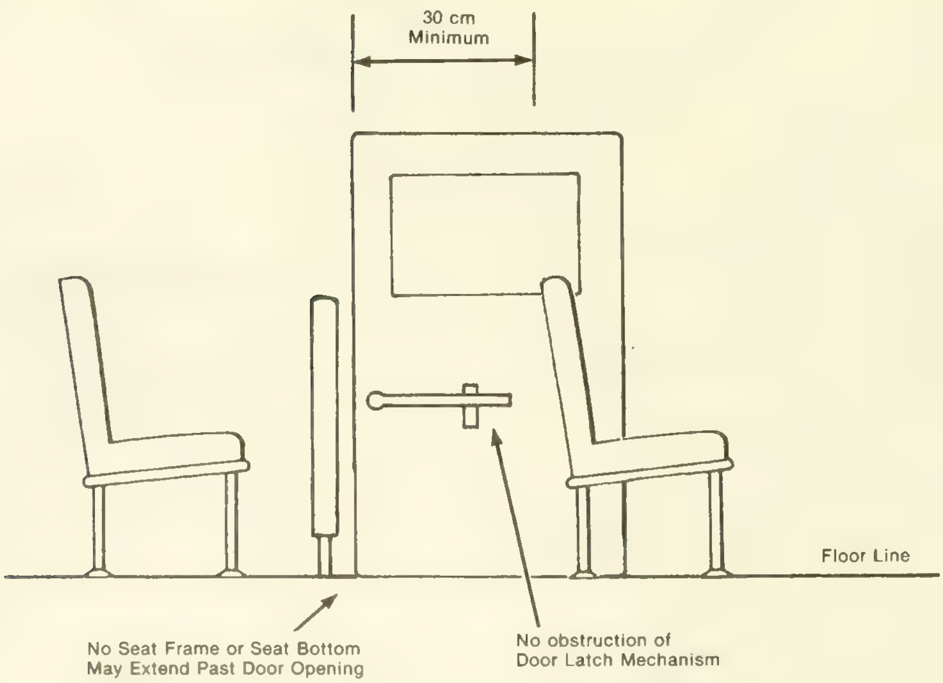


Figure 5C

Table 1. Minimum Specific Intensity Per Unit Area (SIA)

(Candelas per Footcandle Per Square Foot)

Type III Retroreflective Material

A—Glass Bead Retroreflective Element Material

Observation Angle (°)	Entrance Angle (°)	White	Red	Yellow
0.2	-4	250	45	170
0.2	+30	150	25	100
0.5	-4	95	15	62
0.5	+30	65	10	45

B—Prismatic Retroreflective Element Material

Observation Angle (°)	Entrance Angle (°)	White	Red	Yellow
0.2	-4	250	45	170
0.2	+30	95	13.3	64
0.5	-4	200	28	136
0.5	+30	65	10	45

contrasts with its background, shall be located within 6 inches of the release mechanism on the inside surface of the bus.

Example:

(1) Lift to Unlatch
Push to Open

(2) Lift Handle
Push Out to Open.

S5.5.3 School Bus.

(a) Each school bus emergency exit provided in accordance with S5.2.3.1 shall have the designation "Emergency Door" or "Emergency Exit," as appropriate, in letters at least 5 centimeters high, of a color that contrasts with its background. For emergency exit doors, the designation shall be located at the top of, or directly above, the emergency exit door on both the inside and outside surfaces of the bus. The designation for roof exits shall be located on an inside surface of the exit, or within 30 centimeters of the roof exit opening. For emergency window exits, the designation shall be located at the top of, or directly above, or at the bottom of the emergency window exit on both the inside and outside surfaces of the bus.

(b) Concise operating instructions describing the motions necessary to unlatch and open the emergency exit shall be located within 15 centimeters of the release mechanism on the inside surface of the bus. These instructions shall be in letters at least 1 centimeter high and of a color that contrasts with its background

Example:

(1) Lift to Unlatch, Push to Open

(2) Turn Handle, Push Out to Open

(c) Each opening for a required emergency exit shall be outlined around its outside perimeter with a minimum 3 centimeters wide retroreflective tape, either red, white, or yellow in color, that, when tested under the conditions specified in S6.1 of 571.131, meets the criteria specified in Table 1. **(57 F.R. 49413—November 2, 1992. Effective: May 2, 1994)]**

S6. Test conditions.

S6.1 The vehicle is on a flat, horizontal surface.

S6.2 The inside of the vehicle and the outside environment are kept at any temperature from 70° to 85° Fahrenheit for 4 hours immediately preceding the tests and during the tests.

S6.3 For the window retention test, windows are installed, closed, and latched (where latches are provided) in the condition intended for normal bus operation.

S6.4 For the emergency exit release and extension tests, windows are installed as in S6.3, seats, armrests, and interior objects near the windows are installed as for normal use, and seats are in the upright position.

37 F.R. 9394
May 10, 1972

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 218

Motorcycle Helmets

(Docket No. 72–6; Notice 2)

The purpose of this amendment to Part 571 of Title 49, Code of Federal Regulations, is to add a new Motor Vehicle Safety Standard No. 218, Motorcycle Helmets, 49 CFR § 571.218, that establishes minimum performance requirements for motorcycle helmets manufactured for use by motorcyclists and other motor vehicle users.

A notice of proposed rulemaking on this subject was published on May 19, 1972 (37 F.R. 10097). The comments received in response to the notice have been carefully considered in this issuance of a final rule.

In the previous notice, the NHTSA proposed that, effective September 1, 1974, the performance levels for the impact attenuation requirements be upgraded to that of the Head Injury Criterion (HIC) required by Motor Vehicle Safety Standard No. 208. A number of comments on this subject sought to defer a final determination until further research and additional tests could be conducted. The agency has carefully reviewed the issues raised by these comments and has determined that technical data presently being generated on this matter by several investigations should be considered in upgrading the impact attenuation requirements. Accordingly, a decision on the upgrading will be deferred until after this research has been completed and the results evaluated, and after any appropriate data have been reviewed.

Comments to the docket on the initial impact attenuation requirement ranged from abolishing the time duration criteria of 2.0 milliseconds and 4.0 milliseconds at the 200g and 150g levels, respectively, to increasing these criteria to 2.8 milliseconds at the 200g level and 5.6 milliseconds at the 150g level. One approach taken in regard to this requirement contends that the available test data are insufficient for quantifying time limits for the relatively short duration accelerations which are involved in helmet testing. Several comments questioned the validity of the proposed time duration limits, since these limits were based on the optional swing-away (as opposed to fixed anvil) test of the American National Standards Institute (ANSI) Standard Z90.1–1966, which was omitted from the most recent issues of the Z90.1 Standard (1971 and 1973) and was not contained in the proposed motorcycle helmet standard. An additional comment points out that helmets designed to meet higher energy impacts than the initial impact attenuation requirement occasionally have difficulty meeting a 2.0 millisecond requirement at the 200g level.

A review of available biomechanical data indicates that the head impact exposure allowed by the 2.0 and 4.0 millisecond limits at the 200g and 150g levels, respectively, is greater than that allowed by other measures of head injury potential. It is the agency's view, moreover, that the best evidence indicates that an increase in the time duration criteria would permit a substantial reduction in the protection provided to the helmet wearer. Since the comments to the docket did not provide any new data or sufficiently compelling arguments which would justify relaxing the proposed limits for tolerable head impact exposure, the 2.0 and 4.0 millisecond criteria are retained as part of the initial impact attenuation criteria.

In response to comments recommending that the allowable weight of the supporting assembly for the impact attenuation drop test be changed to 20% instead of the proposed 10% of the weight of the drop assembly, the NHTSA has determined that such a change would enable more durable testing equipment to be used with-

out any significant effect on test results. Accordingly, this weight limitation has been raised to 20%.

Several comments expressed concern that the proposed 0.04-inch indentation limit included under the penetration test would create problems of measurement. The agency has determined that the intent of this 0.04-inch indentation limit is sufficiently accomplished by the requirement that the striker not contact the surface of the test headform, and the 0.04-inch indentation limit is therefore deleted from the final rule. Further, in consideration of the need to readily detect any contact by the striker, the agency has determined that the contactable surfaces of the penetration test headforms should be constructed of a metal or metallic alloy which will insure detection. Several minor changes in the test conditions for the penetration test have also been made, without altering the substance of those conditions.

A number of comments recommended that where the retention system consists of components which can be independently fastened without securing the complete assembly, such components should not have to individually meet the retention test requirements. Since helmets have a tendency to be thrown off by a crash and motorcyclists sometimes only partially fasten the retention system where such an option exists, the agency has concluded that retention components as well as the entire assembly should meet the test requirements in every fastening mode as specified in the notice of proposed rulemaking.

A number of comments requested that the 105° minimum peripheral vision clearance to each side of the midsagittal plane be increased to 120°. The 105° minimum requirement was proposed because it satisfies a demand by the public for the availability of some helmets which provide added protection to the temporal areas in exchange for a minimal reduction in peripheral vision capability without compromising the safe limits of peripheral vision clearance. A review of available field-of-vision studies and the lack of any evidence to the contrary indicate that 105° minimum clearance to each side of the midsagittal plane provides ample peripheral vision capability. Since the requests for increasing the minimum clearance to 120° were not accompanied by any supporting data or arguments, the agency has concluded that the standard should allow the additional protection which the 105° minimum clearance would permit and, accordingly, this requirement is retained.

With respect to providing important safety information in the form of labeling, one comment recommended that, due to possible label deterioration, both the manufacturer's identification and the helmet model designation should be permanently marked by etching, branding, stamping, embossing, or molding on the exterior of the helmet shell or on a permanently attached component so as to be visible when the helmet is in use. The NHTSA has determined that the practical effect of this recommendation is accomplished by requiring each helmet to be permanently and legibly labeled. The method to be used to permanently and legibly affix a label for each helmet is therefore left to the discretion of the manufacturer. However, in order that there may be some external, visual evidence of conformity to the standard, the labeling requirement has been further modified to require manufacturer certification in the form of the DOT symbol to appear in permanent form on the exterior of the helmet shell.

One comment recommended that the preliminary test procedures include the application of a 10-pound static test load to the apex of a helmet after it is placed on the reference headform and before the "test line" is drawn to insure that the reference marking will be relatively uniform, thus reducing variances in test results of identical helmets. The agency concurs in this recommendation and it has been included in the standard.

A number of comments objected to the location of the test line. With respect to the proposed requirement that the test line on the anterior portion of a helmet coincide with the reference plane of its corresponding reference headform, it was pointed out that the helmet's brow area would have to be excessively thick in order to meet the impact attenuation criteria at any point less than approximately 1 inch from the brow opening. The data indicate that this objection is valid, and the location of the anterior

test line has been modified by placing it 1 inch above and parallel to the reference plane.

A number of comments objected to the proposed requirement that the test line on the posterior portion of a helmet coincide with the basic plane of its corresponding reference headform. The principal objection expressed concern that, by extending the posterior test line to the basic plane, the resulting increase in the posterior surface of a helmet could cause the helmet to impact the wearer's neck where rearward rotation of the head occurs, thereby increasing the potential for injury in certain cases. After further consideration of this aspect of helmet safety, the agency has determined that the location of the test line on the posterior portion of a helmet should be modified by placing it 1 inch below and parallel to the reference plane.

Several comments questioned the sufficiency of the anatomical dimensions and diagrams provided for the reference headforms in the Appendix of the notice of proposed rulemaking. Of these comments, two proposed adopting the dimensional specifications of the existing ANSI Z90.1 headform, while a third recommended the inclusion of an additional reference headform to accommodate their smallest child helmet. The agency has concluded that, in order to promote greater uniformity in testing and more repeatable results, one of the reference headforms should have the dimensional specifications of the readily available Z90.1 headform, the others being scaled proportionally, and that a reference headform for smaller child helmets should be added. Accordingly, the Appendix has been revised to reflect these changes.

Effective date: March 1, 1974.

In consideration of the foregoing, a new Motor Vehicle Safety Standard No. 218, Motorcycle Helmets, is added as § 571.218 of Title 49, Code of Federal Regulations, as set forth below.

(Secs. 103, 112, 119, Public Law 89-563, 80 Stat. 718, 15 U.S.C. 1392, 1401, 1407; delegation of authority at 49 CFR 1.51.)

Issued on August 9, 1973.

James B. Gregory
Administrator

38 F.R. 22390
August 20, 1973

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 218

Motorcycle Helmets

(Docket No. 72–6; Notice 3)

The purpose of this notice is to respond to petitions for reconsideration and petitions for rulemaking to amend Motor Vehicle Safety Standard No. 218, *Motorcycle Helmets* (49 CFR 571.218).

Standard No. 218, published on August 20, 1973, (38 F.R. 22390), established minimum performance requirements for helmets manufactured for use by motorcyclists and other motor vehicle users. Pursuant to 49 CFR 553.35, petitions for reconsideration were filed by the Safety Helmet Council of America (SHCA) and Lear-Siegler, Inc., Bon-Aire Division. Additionally, pursuant to 49 CFR 553.31, petitions to amend the standard were filed by the Z–90 Committee of the American National Standards Institute, Midwest Plastics Corp., Approved Engineering Test Laboratories, Bell-Toptex, Inc., Premier Seat and Accessory Co., Safetech Co., Sterling Products Co., Inc., Lanco Division of Roper Corp., American Safety Equipment Corp., and Electofilm, Inc.

In response to information contained in both the petitions for reconsideration and the petitions for rulemaking, the standard is being amended in some minor respects, and its effectiveness is temporarily suspended for helmets that must be tested on headform sizes A, B, and D. Requested changes in other requirements of the standard are denied.

1. *Effective date.* The NHTSA received comments from Royal Industries/Grant Division, Jefferson Helmets, Inc., and Rebcor, Inc., urging that the March 1, 1974, effective date be reaffirmed and stating that they either have already produced or could produce helmets by that date which meet the standard's requirements. The NHTSA commends these manufacturers for their outstanding efforts and their positive attitude toward producing safer products.

The parties who submitted petitions, however, all requested some postponement of the standard's effective date. The postponement requests ranged from an indefinite extension to a delay until the manufacturers are able to test helmets to the required headforms, and were sought on the following three grounds: (1) additional time in order to obtain headforms required for reference marking and testing; (2) alleged inadequacy of the headform diagrams provided in the final rule; and (3) inability to find a supplier or forge for the K–1A magnesium alloy required for the impact attenuation test headforms.

As explained in the preamble to the standard, the headforms provided in the Appendix of the notice of proposed rulemaking (May 19, 1972, 37 F.R. 10097), were changed by the agency in order to utilize the readily available Z90.1 headform and to promote greater uniformity in testing and more repeatable results. In view of the fact that the size C headform of the final rule is identical to the Z90.1 headform, is readily available in test laboratories, is used for several ongoing certification programs, and that the other headforms are scaled proportionally, the NHTSA anticipated that competition would motivate both the manufacturers and the test laboratories to take the initiative either to obtain or to produce the other required headforms. It now appears that the problem of finding a supplier or forge for the K–1A magnesium alloy required for the A, B, and D impact attentuation test headforms is substantial enough to justify the requests for a postponement of the standard's effective date for helmets that must be tested on headform sizes A, B, and D.

Because the NHTSA determined that the size C headform would be identical to the Z90.1 headform, the low resonance magnesium alloy (K–1A) specified for making the Z90.1 headform also was specified for headforms required by the standard. Statements that it might be difficult to find suppliers or forges for the material were first made in the petitions on the standard. The NHTSA has determined that other low-resonance magnesium alloys can be substituted for the K–1A type without causing significant variances in the results of any of the helmet tests, so that manufacturers can determine compliance without undue cost penalties even where the K–1A alloy is in short supply. Accordingly, the K–1A alloy is retained as the basic headform material for the standard.

In view of the foregoing considerations with particular emphasis on the fact that testing services through commercial testing laboratories have been readily available for several years for the ANSI Z90.1 Standard headform, which is the size C headform of the standard, the requests for postponing the standard's effective date are denied with respect to helmets that fit headform C.

The petitions for a postponement of the effective date are granted, however, with respect to helmets that must be tested on headforms A, B, and D. A sentence is being added to the Application section of the standard, excepting from its coverage helmets that must be tested on these headform sizes. The second sentence in S6.1.1 of the standard relating to the selection of a reference headform to be used for reference marking should be disregarded until the standard is made effective for helmets that must be tested on headform sizes A, B, and D. To facilitate both the production and availability of headforms, the NHTSA has contracted with the Snell Memorial Foundation to monitor the preparation of detail drawings and model headforms consistent with the requirements of the standard. The drawings and headforms will be included in the docket for public examination upon their completion. A review of the leadtime information provided by the comments to the docket indicates that approximately 8 months of manufacturer leadtime will be needed after the detail dimensional drawings of the A, B, and D headforms become available. When the drawings are available, notice to that effect will be published in the Federal Register. The planned effective date for the A, B, and D-size helmets is 8 months from the date of the publication of that notice.

2. *Time duration criteria for impact attenuation test.* Petitions on the impact attenuation test time duration criteria of paragraphs S5.1(b) ranged from eliminating the time duration criteria of 2.0 milliseconds and 4.0 milliseconds at the 200g and 150g levels, respectively, to increasing these criteria to 3.0 milliseconds at the 200g level and 6.0 milliseconds at the 150g level. None of these petitions raised any issues or submitted any data different from those already considered by the NHTSA. The available biomechanical data indicate that the head impact protection provided to the helmet user by the standard's time duration criteria is greater than that which would result from the proposed changes, and the 2.0 and 4.0 millisecond criteria are retained.

3. *Conditioning period.* One petitioner requested that the 24-hour conditioning requirement for each of the four impact tests in paragraph S6.3 be modified to "4 to 24 hours," consistent with the requirements of ANSI Z90.1, arguing that 4 hours is sufficient to condition a helmet to the various environmental conditions required for the respective tests without compromising the intent of the standard. Upon further study of this matter, the NHTSA has concluded that, although 4 hours would not be sufficient as a general condition, changing the conditioning period to 12 hours would facilitate product testing without compromising the intent of the standard. Accordingly, paragraph S6.3, "Conditioning," is revised by changing the "24-hour" conditioning requirement to "12 hours" in each place the 24-hour requirement appears.

4. *Low temperature conditioning requirement.* Three petitioners objected to the −20° F. low temperature conditioning requirement in paragraph S6.3(b) on the basis that the requirement is overly severe. On review of available information, this agency has determined that precise data on the best low temperature requirements for testing are not available. Pending receipt of more specific information, therefore, the cold

temperature requirement of 14° F. that has been used up to now by the American National Standards Institute appears to be the most appropriate. Accordingly, paragraph S6.3(b), "Low temperature," is revised by changing the "−20° F." conditioning requirement to "14° F.".

5. *Projections.* One petitioner requested that paragraph S5.5, "Projections," be changed to permit a maximum rigid projection inside the helmet shell of 0.080 in. with a minimum diameter of 0.150 in. The basis for this request is to allow for the use of eyelets and rivets for attachment of snaps for face shields and retention systems. The NHTSA is concerned that due care be exercised with regard to minimizing the injury producing potential of such fasteners. Eyelets and rivets for the attachment of snaps should be designed to form a portion of the continuous surface of the inside of the helmet shell. Where they are so designed, such attachments would not be "rigid projections." Accordingly, no revision to this requirement is necessary.

6. *Labeling.* One petitioner recommended that the labeling requirements in paragraph S5.6 be clarified with the help of manufacturers and other interested parties. Since the petitioner did not specify the points requiring clarification and because no other comments were received on this subject, the NHTSA has determined that no sufficient reasons have been given to change the labeling requirements.

In consideration of the foregoing, 49 CFR 571.218, Motor Vehicle Safety Standard No. 218, *Motorcycle Helmets*, is amended. . . .

Effective date: March 1, 1974.

(Secs. 103, 112, 119, Public Law 89–563, 80 Stat. 718, 15 U.S.C. 1392, 1401, 1407; delegation of authority at 49 CFR 1.51.)

Issued on January 23, 1974.

James B. Gregory
Administrator
39 F.R. 3554
January 28, 1974

PREAMBLE TO AN AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 218

Motorcycle Helmets

(Docket No. 72-6; Notice 06)

ACTION: Final Rule.

SUMMARY: The purpose of this notice is to amend Safety Standard No. 218, *Motorcycle Helmets,* to extend application of the current requirements to all helmets that can be placed on the size "C" headform. The amendment is an interim rule requiring the certification of all large-size and many small-size helmets, and will be in effect until test headform sizes "A" and "D" have been developed and incorporated in the standard. This extended application of the standard will establish a minimum level of performance for a large number of helmets that are currently not being tested and certified by manufacturers, but which are suitable for testing on the size "C" headform.

EFFECTIVE DATE: May 1, 1980.

ADDRESSES: Any petitions for reconsideration should refer to the docket number and notice number and be submitted to: National Highway Traffic Safety Administration, Nassif Building, 400 Seventh Street, S.W., Washington, D.C. 20590.

FOR FURTHER INFORMATION CONTACT:

Mr. William J. J. Liu, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, Washington, D.C. 20590 (202-426-2264)

SUPPLEMENTARY INFORMATION: For reasons discussed below, on September 27, 1979, the NHTSA published a notice of proposed rulemaking to require, as an interim measure, the testing and certification of all motorcycle helmets that can be placed on the size "C" headform as described in Safety Standard No. 218 (44 FR 55612). Only one comment was received in response to that notice, supporting the proposal.

Safety Standard No. 218, *Motorcycle Helmets* (49 CFR 571.218), specifies minimum performance requirements for helmets designed for use by motorcyclists and other motor vehicle users. Currently, the standard is only applicable to a portion of the annual helmet production. Paragraph S3 of the standard provides:

> * * * The requirements of this standard apply to helmets that fit headform size C, manufactured on or after March 1, 1974. Helmets that do not fit headform size C will not be covered by this standard until it is extended to those sizes by further amendments.

"Fitting" is intended to mean something that is neither too small nor too large. It excludes not only helmets that are too small to be placed on the size "C" headform, but also helmets so large that they could be placed on the size "D" headform were it available. As explained below, that headform size is not currently available.

The standard references and describes in its appendix four test headform sizes ("A", "B", "C", and "D"). Currently only test headform size "C" has been developed, and it is identical to the American National Standard specifications for Protective Headgear for Vehicular Users, ANSI Z90.1-1971. The other test headforms are to be scaled proportionately from the ANSI Z90 (size "C") headform. The performance requirements of the standard for helmets fitting other than size C headforms were held in abeyance until these additional headform sizes could be developed (39 FR 3554, January 28, 1974). Because of problems with prototype headforms supplied to NHTSA under contract (the headforms did not meet

dimensional tolerances considered acceptable), development of these additional headforms has been delayed over the past years. However, the agency now anticipates that the standard will include requirements for headform sizes "A" and "D" effective April 1, 1982 (size "B" will be deleted from the standard).

Last year, the Safety Helmet Council of America (SHCA) recommended that the agency require certification of all adult-size helmets on the size "C" headform. The SHCA stated that the delay in development of the additional headform sizes has led to confusion and unfair practices since many helmets are reportedly being improperly certified and many other helmets are not being certified that are required to comply with the standard. The agency has stated in the past that only helmets that are subject to compliance with Standard No. 218 should be certified and labeled with the "DOT" symbol. Apparently, some manufacturers have used the "DOT" label on untested helmets for competitive purposes. The SHCA stated that these practices have placed considerable burdens on the integrity of manufacturers of high quality helmets. The organization pointed out that under the ANSI standard only one headform (size "C") was used to test all helmets except child-size helmets, and that approximately 95 percent of current helmet production could and should be tested on the size "C" headform and certified for compliance with Standard No. 218.

The NHTSA Office of Vehicle Safety Standards has investigated the current labeling and certification practices of helmet manufacturers. It was found that most manufacturers currently test only "medium" size helmets on the size "C" headform, yet there is considerable variation among manufacturers as to which helmets are considered medium. Further, the agency found that the percentage of helmets subject to certification under the current applicability of the standard is substantially greater than the 40 percent that manufacturers are now testing on the size "C" headform. (Data from the investigation have been placed in the NHTSA docket under the docket number of this notice.)

As stated earlier, under the existing applicability requirements of the standard, only helmets that "fit" headform size "C" must be certified. Apparently, interpretation of the term "fit" by manufacturers has led to some mislabelings and failures to certify. Under the existing requirements, "helmets that fit headform size C" should be all helmets other than those that must be tested on the other headform sizes. To determine which helmets must be tested on a particular headform size, one follows the procedures of paragraph S6.1.1 of the standard. That paragraph provides in part:

> * * * Place the complete helmet to be tested on the reference headform of the largest size specified in the Appendix whose circumference is not greater than the internal circumference of the headband when adjusted to its largest setting, or if no headband is provided to the corresponding interior surface of the helmet.

Using the procedure of paragraph S6.1.1, manufacturers currently need only concern themselves with headform sizes "C" and "D", since small, child-size helmets that could not physically be placed on the size "C" headform would not have to be tested. As to the other helmet sizes, helmets that "fit headform size C" means any helmet that can be placed on the size "C" headform, except those helmets which the manufacturer can demonstrate could be placed on a size "D" headform. To make that demonstration, the manufacturers would have to show that the internal circumference of the helmet headband or the corresponding interior surface of the helmet is larger than the circumference of the size "D" headform. Even though the size "D" headform is not currently available, the dimensions of the headform are specified in the appendix of the standard, from which the manufacturer can make its determination. Regarding small, child-size helmets, the determination whether or not a particular helmet can be placed on the size "C" headform should be based on normal fitting procedures. This means, for example, that undue force should not be applied to forcibly push the headform into the helmet. However, efforts necessary for the ordinary wearing of the helmet should be employed, such as expanding the lower portions of a flexible-shell, full-face helmet. Apparently, many manufacturers have failed to use these procedures for determining which of their helmets "fit" headform size "C" and must be certified.

In light of the improper certification and the noncertification, the unavailability of the additional headform sizes at the present time, the

need to ensure the safe performance of the large helmets and the apparent sufficiency of the size "C" headform for testing large helmets, the agency has concluded that the recommendations of the Safety Helmet Council of America have merit. Therefore, this notice amends Safety Standard No. 218 to require all motorcycle helmets that can be placed on the size "C" headform to be certified in accordance with the requirements of the standard. "Placed" is a broader term than "fit" primarily in that the former term does not imply any upper limit on helmet size.

Under these interim requirements, more than 90 percent of current helmet production will be tested on the size "C" headform. Only small, child-size helmets (size "A") will be excluded since they cannot physically be placed on the size "C" headform. As noted in the procedures discussed above, normal fitting procedures are used to determine if a particular helmet can be placed on the size "C" headform, without the use of undue force.

During its investigation, the NHTSA contacted manufacturers whose collective market share exceeds 80 percent of current annual helmet production. All of these manufacturers indicated that 90 percent or more of their helmet production could be placed and tested on the size "C" headform. Many of the manufacturers indicated that they are already testing the majority of their helmets on the size "C" headform for quality-control purposes, even though not required by the standard. Also, it was found that helmet shells and performance characteristics of a particular manufacturer's helmets do not generally vary significantly over the various size ranges of helmets produced.

This amendment is only an interim measure to establish a minimum level of performance for the large number of helmets that are currently not being certified for compliance with Standard No. 218. Testing extra-large helmets on the size "D" headform would require a higher level of performance for those helmets, since the weight of the size "D" headform is greater than that of the size "C" headform. Therefore, development of the size "A" and size "D" headforms has continued, and incorporation of requirements in the standard for these headforms will occur after development is completed. However, until this is accomplished, the agency believes that the performance level that will be required by testing on the size "C" headform is preferable to an absence of any requirements whatsoever. As stated earlier, the ANSI standard for helmets specifies only one headform size ("C") for testing all helmets. The additional headform sizes were originally specified in Standard No. 218 in response to suggestions from some manufacturers that requirements be more "fine-tuned" for the various helmet sizes.

The agency has concluded that the new requirements will preclude the great majority of unsafe helmets currently on the road. Further, with all adult helmets certified, retailers and consumers will no longer be confused or misled concerning the DOT certification labels found in their helmets, and NHTSA's enforcement activities will become more effective and uniform.

Under these new requirements, extra-large helmets should be tested on the size "C" headform without the use of "shims" or other devices to obtain a secure fit of the helmet on the headform. Agency tests involving extra-large helmets on the size "C" headform show results that correlate well with tests of medium-size helmets on the size "C" headform. (Data from these tests have been placed in the NHTSA docket). Therefore, the agency has concluded that repeatable results can be obtained under the existing procedures with the size "C" headform.

The effective date for extending the applicability of Standard No. 218 to all helmets that can be placed on the size "C" headform is May 1, 1980. The agency's past position has been that it would be "false and misleading," within the meaning of the statute (15 U.S.C. 1397(C)), for a "DOT" symbol to appear without qualification on helmets manufactured before the effective date of the standard. However, since the standard is currently effective for helmets that fit size "C" headforms, and since there is such a widespread variation among manufacturers as to which helmets they consider to fit the size "C" headform, the agency will allow voluntary certification and labeling of helmets prior to May 1, 1980. This, of course, would only apply to helmets that can be placed on the size "C" headform. Small helmets that could not be placed on the headform could not be certified with the "DOT" symbol until after the

standard has been amended to include specifications for the size "A" headform. Also, helmets certified and labeled with the "DOT" symbol prior to the May 1, 1980, effective date will be subject to the general enforcement provisions of the National Traffic and Motor Vehicle Safety Act. Therefore, manufacturers will have to exercise "due care" to assure that any helmet they certify in fact complies with the performance requirements of Standard No. 218.

The agency has determined that this amendment does not qualify as a significant regulation under Executive Order 12044, "Improving Government Regulations." A final regulatory evaluation of this amendment has been placed in the docket for the benefit of all interested persons.

The engineer and lawyer primarily responsible for the development of this notice are William J. J. Liu and Hugh Oates, respectively.

In consideration of the above, paragraph S3 of Safety Standard No. 218, *Motorcycle Helmets* (49 CFR 571.218), is amended to read as follows:

§ 571.218 *Standard No. 218; motorcycle helmets.*

* * * * *

S3. *Application.* This standard applies to helmets designed for use by motorcyclists and other motor vehicle users. The requirements of this standard apply to all helmets that can be placed on the size C headform using normal fitting procedures. Helmets that cannot be placed on the size C headform will not be covered by this standard until it is extended to those sizes by further amendment.

* * * * *

(The second sentence in S6.1.1 of the standard relating to the selection of a reference headform should be disregarded until the standard is made effective for helmets that must be tested on headform sizes A and D.)

Issued on February 29, 1980.

Joan Claybrook
Administrator

45 F.R. 15179
March 10, 1980

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 218

Motorcycle Helmets
(Docket No. 85-11; Notice 2)

ACTION: Final Rule

SUMMARY: This rule announces changes to Federal Motor Vehicle Safety Standard 218, *Motorcycle Helmets.* On September 27, 1985, the agency proposed to extend its performance requirements for the first time to all helmet sizes and to improve its test procedures and conditions. In addition, the agency requested comments on several cost-related questions and issues related to possible future motorcycle helmet rulemakings. This final rule responds to the public comments and amends the motorcycle helmet safety standard. This improved standard will benefit motorcyclists, moped and other motor vehicle users who wear motorcyle helmets.

EFFECTIVE DATE: October 3, 1988.

SUPPLEMENTARY INFORMATION:

Background

Section 103 of the National Traffic and Motor Vehicle Safety Act of 1966 (15 U.S.C. 1392) requires the establishment of Federal safety standards for motor vehicles and motor vehicle equipment. These standards are amended by the National Highway Traffic Safety Administration (NHTSA) as appropriate, such as when new safety data become available or technological developments warrant.

The agency's first Federal motor vehicle safety standard for motorcycle helmets (FMVSS 218) became effective in 1974. Although this standard has been demonstrated to be a significant factor in the reduction of critical and fatal injuries involving motorcyclists in motorcycle accidents, the standard has thus far not applied to all motorcycle helmets sold in the United States. Because of limited availability of headforms on which to test motorcycle helmets, FMVSS 218 previously applied only to motorcycle helmets that could be "placed on" the available size C headform. As a practical matter, this has limited the application of the standard to medium and large motorcycle helmets, since small motorcycle helmets could not be placed on the size C headform. Small helmets constitute approximately 10 percent of the motorcycle helmet market.

A manufacturer of a motorcycle helmet subject to FMVSS 218 must certify that the helmet meets all of the standard's requirements. Those requirements include performance requirements for helmets for impact attenuation (shock absorption), penetration resistance (a sharp object striking the helmet), and retention (chin strap strength). Tests to determine compliance with these requirements are conducted under prescribed conditions, with the helmet secured to a metal test headform. In addition, FMVSS 218 establishes requirements dealing with peripheral vision, labeling, and internal and external projections.

Current FMVSS 218

The first of the three principle performance requirements in FMVSS 218 is that a motorcycle helmet must exhibit a minimum level of shock absorbency upon impact with a fixed, hard object. Compliance is determined by a two-part impact attenuation test. This test involves placing motorcycle helmet on the test headform and dropping the headform and helmet (known as the headform assembly) in a guided free fall first onto a flat steel anvil and then, in a separate test, onto a hemispherical steel anvil. Each helmet is impacted at four sites with two successive, identical impacts at each site, at any point on the area above a prescribed test line. Two of these sites are impacted upon the flat anvil by dropping the headform assembly from a height of 72 inches (182.9 centimeters), and two sites are impacted upon the hemispherical anvil from a height of 54.5 inches (138.4 centimeters).

The impact attenuation requirement is expressed as limits on the acceleration levels of the headform and is quantified in g's, the gravitational acceleration, and used as the unit of acceleration. The acceleration level relates directly to the impact on the brain. The greater the number of g's, the greater the force or impact energy that is applied to the brain. A number of test studies (including the 1980 study by the Japanese Automobile Research Institute, discussed later in this preamble) express the threshold of injury to the human brain in g's. Standard 218 limits acceleration to a peak level of 400g and requires that no helmet exceed 200g for a cumulative

duration of more than 2.0 milliseconds and 150g for a cumulative duration of more than 4.0 milliseconds.

Four impact attenuation tests must be conducted within a specified time limit (discussed later in this preamble) and each must be conducted after the helmet has been conditioned in one of four conditioning environments for 12 hours. These conditioning environments are:

(a) Ambient conditions: exposure to 70°F (21°C) and relative humidity of 50 percent.
(b) Low temperature: exposure to 14°F (−10°C).
(c) High temperature: exposure to 122°F (50°C).
(d) Water immersion: with water at 77°F (25°C).

The second performance requirement is a penetration test, in which a metal striker is dropped 118.1 inches (3.0 meters) in a guided free fall onto a stationary helmet. Two penetration blows are applied at least 3 inches (7.6 centimeters) apart from each other and at least three inches from the centers of the impact attenuation blows. To meet the performance requirement, the striker may only come in contact with the helmet and may not come in contact with the surface of the headform. The penetration test, like the impact attenuation test, is conducted within certain time constraints and with the helmet conditioned in the four previously mentioned environments.

The third performance requirement of Standard 218 tests chin strap strength. It requires that the retention system or any component of the retention system of a motorcycle helmet be able to withstand a preliminary load of 50 pounds (22.7 kilograms) of tensile force (for 30 seconds) and then a test load of an additional 250 pounds (113.4 kilograms) (for 120 seconds). To meet the performance requirement, the helmet retention system may not break during the times loads are applied and the adjustable portion of the retention system device may not move more than one inch between preliminary and test load conditions. If a retention system consists of components, each component must meet these requirements. As with the impact attenuation and penetration tests, the motorcycle helmet must be exposed to the four conditioning environments before being tested for the retention requirements.

Standard 218 also prescribes requirements for labeling, projections, and peripheral vision requirements. A manufacturer must permanently affix to each helmet labeling which includes the manufacturer's name or identification, precise model designation, size, month and year of manufacture, and, as a certification of compliance with the standard, the DOT symbol. The labeling requirements also provide that the manufacturer must supply to the purchaser information concerning shell and liner composition, cleaning instructions, and warnings to make no modifications, and to have the helmet checked by the manufacturer or destroyed if it experiences a severe blow. This additional information may be conveyed on a tag attached to the helmet, or by other appropriate means.

Standard 218 does not allow any rigid projections inside the shell and limits those outside the shell to those needed to operate essential accessories. An external protrusion may not be more than .20 inch (the new provision adopted in this rulemaking is .20 inch; the currently effective limit is .19 inch). Finally, Standard 218 requires that the helmet provide a minimum of 105° peripheral vision to either side of the mid-sagittal plane (the middle of the face).

Each manufacturer must certify that its helmets meet the performance requirements of the standard before the helmets are offered for sale. The test procedures in Standard 218 specify the manner in which procedures will be conducted by any laboratory under contract with NHTSA to test helmet compliance. Additional details on how the tests are to be conducted are contained in NHTSA Laboratory Procedure for Motorcycle Helmet Testing (TP-218-02; October 18, 1984).

The Proposed Rule and Public Comment

The agency proposed changes to FMVSS 218 on September 27, 1985 (50 FR 39144). In addition to specific changes in the Standard, the agency sought public comment on eight cost-related questions and six issues for possible future rulemaking. In response, the agency received public comments for four motorcycle helmet manufacturers (Bell Helmets, Inc., Florida Safety Products, Inc., Javelin, Inc., and Marushin Kogyo Co., Ltd) and from one company that manufactures test equipment and tests motorcycle helmets (United States Testing Company, Inc.). The proposed changes, the issues raised by the agency for possible future rulemaking, as well as public comment submitted on these, are discussed below.

Applicability of Standard to All Helmets (S3.). The principal change in FMVSS 218 is the extension of the standard to all motorcycle helmet sizes. It has been the agency's intention since it promulgated its first motorcycle helmet safety standard to extend this standard to all helmets as soon as practicable. The principal cause of the delay in doing this has been the lack of availability of headforms other than the size C headform. This situation resulted in limited application of the standard, since small motorcycle helmets were not able to be placed on the size C headform to be tested and thus were not required to be certified as complying with FMVSS 218.

This impediment no longer exists, because the agency has developed three new test headforms, small, medium, and large, which will replace the single size C headform. The September 27, 1985, proposed rule contained a lengthy description of the process used to develop these headforms. The basic steps

included the development of a numerical table describing the exterior geometry of old size C headform and the creation of a new medium headform based on the table. The table then was used to derive the measurements for a small headform and a large headform, using a scaling factor of 0.8941 for the small headform and a scaling factor of 1.069 for the large headform. Detailed specifications for the headforms are contained in the Appendix to the final rule; these specifications should ensure that each headform can be accurately cast and/or machined.

As the result of testing, the agency believes that helmets previously tested on the size C headform will achieve comparable results on the new medium headform. In addition, the three new headforms will provide a more reliable fit for all helmets being tested, thereby increasing the repeatability of the testing.

For the first time, the agency proposed details on the interior geometry of the headform. While the proposal would allow the agency to retain some flexibility on the details of the interior of the headform (to allow for differently designed support assemblies and still retain the ability to meet the standard's test headform and support assembly weight requirement for the impact attenuation test), the level of specificity would be sufficient to establish a fixed center of gravity for the test headform—the center of the ball socket joint. Being able to fix the center of gravity (and, thus, fix the location of the accelerometer as well, since the accelerometer is located at the headform's center of gravity) also enhances the test's repeatability.

No specific comments were received on the development of the new headforms, although United States Testing Company, Inc., (U.S. Testing) stated that it generally supported the proposed changes in the proposed rule. In addition, Javelin, Inc., (Javelin) stated that it did not oppose the proposed test headform system. The final rule adopts the new small, medium, and large headforms as proposed.

Since the proposed dimensions of the exterior and interior of the headforms were published, the agency has noted in the FMVSS 218 rulemaking docket that the manufacturer of the headforms used for the agency's testing has made minor modifications to the interior of the headform. The manufacturer has changed the size of the four holes inside the headform for the tie-down screws from ¼ inch-20 helical coil insert to $\frac{5}{16}$ inch-18 helical coil insert. These changes have been made to all headform sizes to increase the holding power of the screws to the headform. These changes also may reduce the frequency of adjustments to the monorail test equipment, especially when the large test headform is used. These changes are reflected in Figures 6, 7, and 8 in the Appendix to the Standard.

Impact Attenuation Test (S5.1). The current impact attenuation performance test limits the acceleration levels of the test headform. Expressed in g's, a test headform acceleration level is limited to a maximum of 400g. In addition, acceleration in excess of 200g is limited to a cumulative duration of 2.0 milliseconds and acceleration in excess of 150g to a cumulative duration of 4.0 milliseconds. Recent confirmation of the appropriateness of these requirements is found in the 1980 study of the Japan Automobile Research Institute, Inc., "Human Head Tolerance to Sagittal Impact: Reliable Estimation Deduced from Experimental Head Injury Using Subhuman Primates and Human Cadaver Skulls," K. Ono, A. Kikuchi, M. Nakamura, H. Kobayashi, and N. Nakamura, Proceedings from the 24th Stapp Car Crash Conference, SAE 801303, 1980 (JARI study). The JARI study developed a human head impact tolerance threshold curve, which indicates that the threshold of human concussion is about 200g at 2.3 milliseconds. Standard 218's limitation of 200g at 2.0 milliseconds provides the necessary margin of safety. The agency's compliance testing shows that, in general, modern helmet technology has no problem meeting these requirements.

Although the impact attenuation test's acceleration levels were not proposed for change, the agency solicited comments on the issue. Both Javelin and Bell Helmets, Inc., (Bell) submitted comments and both recommended that the peak g be lowered (currently 400g)—Javelin recommending that it be lowered to 250g and Bell that it be lowered to 300g. Javelin stated that most brain injuries start below 400g and that there are no brain injuries at 250g. Neither Javelin nor Bell submitted data to support its position.

With regard to the dwell time requirements (limiting acceleration of 200g to 2.0 milliseconds and acceleration of 150g to 4.0 milliseconds), Bell stated that the original dwell times were established when the compliance test system was a swing-away test rig. Thus, when the standard changed to a drop test approach, the time duration increased on all of the helmets. Bell's contention is that this was due to the change in the system, and not because of any change in the helmets.

Bell tried to discount the agency's use of the dwell time requirements by hypothesizing that what NHTSA really is regulating is a change in velocity, since NHTSA establishes maximum g levels for certain periods of time and the product of acceleration and time duration is velocity. Using this premise, Bell contends that NHTSA would fail a change in velocity greater than 3.923 meters per second at 200g for 2 milliseconds duration or more, yet would allow a change in velocity of 7.8 meters per second at 199g for 4 milliseconds duration or less. Bell commented that the standard implies that "more is less," because NHTSA would say a change in velocity of 3.923 meters per second at 200g is life threatening, but a change in velocity of 7.8 meters per second at 199g is within human tolerance.

Bell misunderstands the role of change of velocity in relation to the dwell time requirements of FMVSS 218, and bases all of its calculations on a limited and erroneous assumption. Bell assumes that, since both acceleration and time are elements of the performance requirement, the agency is regulating change in velocity (maximum acceleration multiplied by time duration, in the case of rectangular g–t curves). In addition, Bell developed its "more is less" theory solely on the basis of calculating change of velocity from a single rectangular acceleration-time response curve.

Calculating change of velocity from a rectangular g–t curve can result in many different impacts generating the same change of velocity. For example, a change of velocity of 9.82 m/sec is the measure of a rectangular response curve of 500g–2t (t = milliseconds, which would represent an impact on a hard surface with a high acceleration level and short stopping time), as well as the measure of a rectangular response curve of 2g–500t (which would represent an impact on a soft surface, with low acceleration and long stopping time). While these two examples have the same change of velocity measure, clearly the 500g–2t response is highly injurious while the 2g–500t is not. The sameness in the change of velocity in these very different examples demonstrates that change of velocity alone is insufficient to determine injury.

As previously stated, the agency is not regulating change in velocity because it alone is not sufficient to relate impact and injury. Rather, researchers believe that peak acceleration and time duration at a certain level of acceleration are accurate determinatives of human brain injury potential. Limiting peak g and time duration for the acceleration-time response curve, although defining limits for the elements which also constitute change of velocity, is not limiting change in velocity. In summary, the agency believes the basic premise of Bell's comment is grounded in a misunderstanding of the role that change of velocity plays in applying time duration requirements to performance levels of motorcycle helmets. Further, Bell's reliance only on rectangular response curves is inappropriate.

In response to the other commenters recommending a lower maximum g level, the agency appreciates that there is difference of opinion in the helmet manufacturing industry. We encourage any commenter wishing that the agency consider a change in the requirement to submit biomechanical data in support of its position. To date, the commenters have not submitted data which supports or contradicts ir any way the 1980 JARI study. The current requirements in FMVSS 218 are consistent with the JARI study. Accordingly, the agency believes that they are appropriate.

Retention Test-(a) Dynamic Testing (S5.3). The agency asked whether the retention test should be changed to require dynamic testing to prevent the helmet from rotating on the head and perhaps coming off the head in an accident. Bell responded that they have done considerable research and development on this, and that retention testing should include a dynamic test to check roll-off as well as strap strength.

Retention Test-(b) Chin Guard Area. The agency asked if the standard should include procedures for the chin guard area or full facial coverage of the helmet. Bell answered affirmatively, stating that a test for face bars should be developed.

With respect to the retention test responses, for both the dynamic testing question and the chin guard area question, no substantive or quantitative data were submitted. The agency will consider changes with regard to the helmet's retention system, but only if it receives appropriate data. The agency requests data to be submitted as they become available.

Projections (S5.5). Although the agency did not propose any change to the prohibition against rigid interior projections, Marushin submitted a comment requesting that the agency define "rigid." Marushin stated that it is not realistic to prohibit *all* rigid projections inside the shell, because any fastening system for essential accessories would have some kind of inside projection. The agency will consider a clarifying amendment on rigid projections as an issue for possible future rulemaking.

Selection of Applicable Test Headform (New S6.1). The proposed rule contained a new S6.1, Selection of appropriate headform, specifying designated size ranges of helmets to be tested on the small, medium, and large test headforms. The premise of the proposal was that each helmet should be tested on the headform that correlated most closely with the heads of persons likely to purchase the helmet. The agency believed that the manufacturer's size designation was the best method for determining the likely size of those heads. The proposal called for a helmet with a manufacturer's designated helmet size or size range of 6 5/8 (European size 53) or smaller to be tested only on the small headform; a helmet with a manufacturer's designated helmet size or size range between 6 3/4 and 7 1/2 (between European size 54 and size 60) to be tested on the medium headform; and a helmet with a manufacturer's designated size or size range of 7 5/8 (European size 61) or larger to be tested on the large headform. Paragraph S6.1.2 further provided that any helmet having a designated size range that overlaps all or a portion of two or more of the three specified ranges must be tested on all headforms included within the helmet's size range.

Bell recommended that the upper end of the small headform size be changed from 6 5/8 to 6 3/4, because Bell's helmets sized at 6 3/4 cannot be placed on the

medium headform. The intention of the proposed changes is to ensure that all motorcycle helmets are subject to compliance testing. Accordingly, the final rule reflects Bell's requested change in sizing.

Marushin Kogyo Co. (Marushin) requested that the agency define the measuring method of each helmet size, including the contour to be measured and the measuring device. Marushin also requested that the metric unit of the helmet size be added to the standard. The agency declines to specify how a manufacturer should measure its helmets for sizing, because this reflects design considerations which are most appropriately determined by the manufacturers. Also, the designation method used in the proposed rule provides adequate size information, since it is adopted from long-established industry procedures. The American designation, for example, 6 3/4, indicates 6 3/4 inches, the diameter of an equivalent circle; the European equivalent in parentheses, for example 54, indicates 54 centimeters, the circumference of the equivalent circle. No change has been made in the final rule.

Bell opposed the requirement that a helmet be tested on more than one headform if its sizing extends beyond the limits of a single size range. As an alternative, Bell suggested that any helmet falling within the size ranges of two or more headforms be tested on the largest of those headforms, noting that approximately 5 percent of its helmets would have to be double tested under the proposed rule.

The agency has reviewed test results of the same helmet being tested on two different size headforms, and has found that the results are not consistent. Some smaller helmets tested better on larger test headforms and some larger helmets tested better on smaller test headforms. This is an indication to the agency that testing only on the larger headform as Bell suggests would not ensure that a given helmet also would pass the performance requirements when tested on a small headform. The agency therefore believes the multiple testing rule is needed to ensure that any helmet falling within the size range for any particular headform size meets the performance requirements when tested on that headform. No change has been made in the final rule.

Headform Test Line (New S6.2.3). Paragraph S6.2.3 describes how to determine the test line of a helmet and Figure 2 in FMVSS 218 graphically shows the test line on a headform. All strikes or impacts must be above the designated test line. The area above the test line represents the more vulnerable area of the skull and the required test area on a motorcycle helmet. In the proposed rule, the agency asked three questions related to the helmet test line:

1. Should the test line marking the limit of the test surface in Figure 2 of the Standard be lowered or should the test be revised in other ways to provide more protection in accidents for the lower part of the back of the head or the front of the head in the forehead area, or to improve the performance of the helmet from the side?

2. What requirements would represent the optimal trade-off between helmet weight, visibility, hearing and other helmet design criteria?

3. Do current requirements represent a reasonable trade-off?

Bell was the only commenter to respond to these questions. While Bell stated that FMVSS 218 has proven to offer good protection within the existing trade-offs scheme, Bell did recommend that the test line be lowered in the back of the head area. Bell or any other manufacturer desiring that NHTSA consider revising the test line in a future rulemaking should submit support data.

Temperature Conditioning (New S6.4) The agency asked whether the low temperature conditioning requirements should be changed so that the interior surface of the helmet, or the headform, is at body temperature for the impact attenuation and penetration tests.

Bell stated that it believes the agency should consider the inner and outer temperatures of the test helmets. Florida Safety Products, Inc., (Florida) believes that any tests on a helmet subjected to low temperature conditions is unrelated to real life conditions, unless the helmet has a simulated human head in it. Florida has tested helmets conditioned to 10°F containing a bladder conditioned to 98°F to simulate a human head. Although it did not elaborate, Florida indicated that these test conditions produced a "startling difference in test results" from those for helmets tested under current FMVSS 218 procedures.

Florida also attached a U.S. Army Aeromedical Research Laboratory study on this subject, which concluded that the current FMVSS 218 requirements do not simulate potential, real world, cold climate conditions, particularly because the headform is deemed too cold, and therefore are inappropriate for the determination of cold temperature dynamic response of a helmet system. The study recommended that testing be done under conditions that simulate potential, real world conditions as closely as possible. Florida concluded its comments by recommending a change in the standard which would require that the test headform be conditioned to body temperature for the impact attenuation and penetration tests.

The agency acknowledges that temperature gradients exist, and that the temperature of the test headform (or other substance on which the helmet is placed) may affect the temperature of the helmet. However, what the agency lacks, and what the commenters did not submit, are any data indicating any link between differences in impact attenuation and penetration test results and changes in temperature. NHTSA requests any data, including specific test

results, which the agency may use to evaluate future rulemaking decisions.

Bell also commented on the procedure used to wet the motorcycle helmet for the water immersion conditioning requirement (new S6.4.1(d)), recommending that the wet test be a "spray" type test as opposed to the current soak test. Bell further stated that they have indications that some of the liners have been moved out of position because of excess water in the helmet. As with other "new" information received from commenters, the agency will consider this recommendation in the context of a possible future rulemaking and requests the submission of specific data.

Second Impact. The impact attenuation test (S7.1.2) states that each helmet is impacted with two successive, identical blows at each site, from a drop height of 72 inches onto the flat anvil and from a drop height of 54.5 inches onto the hemispherical anvil.

Javelin recommended that the agency change the impact attenuation test conditions. Their recommendation was that the agency eliminate the requirement for the second impact at each site and, in the alternative, specify 120J impact energy for the first (and only) impact on the flat anvil and 95J impact energy for the first (and only) impact on the hemispherical anvil (J = joules, a measure of energy).

Translating J's into drop heights, Javelin's recommendation for the medium test headform assembly would be approximately 97.2 inches, as opposed to FMVSS 218's drop height of 72 inches onto the flat anvil. The equivalent drop height for 95J is about 76 inches, as opposed to FMVSS 218's drop height of 54.5 inches onto the hemispherical anvil. If adopted, expressing the impact requirements in terms of energy units means that the drop heights would be dependent upon the mass of the test headform used and would be different for each size test headform.

Conversely, Javelin's recommendation would require that the same amount of energy be used for each size headform. However, Javelin did not provide any supporting data for their proposed test procedure change. The current FMVSS requires that the different size test headform and motorcyle helmet assembly be dropped from the same height, which results in different amounts of energy being imparted, since impact energy changes with mass, and the different headform assemblies have different amounts of mass. The agency adopted the single height requirement to simulate crash conditions. NHTSA believes that a consistent drop height more accurately simulates reality than a consistent measure of energy.

With regard to eliminating the second impact, the agency believes that current FMVSS 218 establishes minimum performance requirements. The purpose of requiring the second impact at each test site is to establish a minimum level of helmet residual impact absorbing capability. In real world accidents, a second impact may occur quickly after the first, perhaps within one or two seconds and perhaps at a different place. While there is no existing test method for conducting second impacts within such a short time frame, it is known that the human head's tolerance is lowered when subjected to repeated blows.

While the agency's second impact test does not reproduce potential, multiple impacts in a single accident, it does establish that the material has sufficient ability to recover its protective capabilities in the particular location where it has been impacted. For these reasons, the agency believes that retaining a second impact test is important.

While various manufacturers have recommended that the agency eliminate the second impact requirement, no one has submitted data to demonstrate that the second impact is not appropriate or provided a rationale for eliminating the requirement. In fact, all other known standards which have been established by private standards organizations or by foreign countries require equal or higher impact levels than FMVSS 218 for both the first and second impacts. Absent contradictory data, the agency believes that it is appropriate to retain the standard's current requirements.

Test Conditions: Time Limitations for the Impact Attenuation Test and Penetration Test. The NPRM proposed that the impact attenuation test (new S7.1.3) and the penetration test (new S7.2.3) start at exactly two minutes following removal of the helmet from the conditioning environment and that the two successive impacts for each test site be completed within four minutes. If either time requirement is not met, the helmet must be returned to the conditioning environment and the test series begun again. Under the current standard, there is no minimum starting time but the impacts must be conducted within five minutes. The reduction in test time limits will reduce the temperature variations from test to test with the same helmet and will provide more repeatable test results.

The agency also requested comments from manufacturers and test laboratories about whether a helmet's performance during the retention test (chin strap) is also temperature sensitive.

The agency did not receive any comments on its proposed time limitation changes to the standard or on its request concerning the time sensitivity of the retention system test. The proposed rule provisions are adopted in the final rule without change.

Resonant Frequency of the Test Headform (New S7.1.5). The NPRM provided that a test headform may not exhibit resonant frequencies below 2,000 Hz (cycles/seconds) (new S7.1.5), lowered from the currently specified 3,000 Hz (old S7.1.4). The purpose of this requirement is to ensure that headform frequencies do not distort helmet response measurement. The fundamental helmet frequency is estimated to be

below 1,000 Hz and the tested resonant frequencies for the new small, medium, and large headforms exhibit frequencies well above 2,000 Hz. Setting a minimum resonant frequency of 2,000 Hz for the headform will eliminate any risk of interference with test results, while allowing some flexibility in the design and machining of headform interiors (for example, there can be variations in wall thickness).

Since the agency did not receive any comments on this provision, it adopts the requirement as proposed.

Use of the Monorail Drop Test Equipment (New S7.1.6). The agency specified in the proposed standard that it would use the monorail drop test equipment in the conduct of the impact attenuation test (new S7.1.6). The agency has been using the monorail drop test equipment, but it has not specified its use in the standard before. The agency uses the monorail drop test equipment because the impact point on the helmet can be fixed. The other frequently used system, the twin wire system, allows the headform assembly to rotate downward, making it hard to predict successive impact points. Added friction due to this downward rotation can cause speed variations, which in turn may produce response variations.

The agency received several comments on its use of the monorail drop test equipment. Javelin suggested that test equipment be optional to the manufacturer, contending that if the twin-wire equipment is adjusted, it can match the performance of the monorail drop test equipment. Bell, while not objecting to the monorail drop test equipment itself, questioned the agency's statement that the monorail drop test equipment is more consistent, contending that two NHTSA contract laboratories, Dayton T. Brown and Southwest Research, had different test results with the monorail drop test equipment. Finally, Marushin specifically requested that the twin-wire system be authorized, since it is Marushin's belief that the reliance on the monorail drop test equipment is premature and that the twin-wire testing system is the most common system in place throughout the world. As a practical matter, Marushin does not know of a reliable source from which to get the monorail drop test equipment.

The agency does not consider the different test results experienced by Dayton T. Brown and Southwest Research as being comparable. Certain test differences were due to differences in instrument control practice. However, according to a worst case analysis report provided by each laboratory, variance due to instrumentation differences alone is less than five percent, well within the tolerance range. As mentioned earlier, NHTSA's Laboratory Procedure for Motorcycle Helmet Testing (TP-218-02, October 1984) includes procedures for the calibration of measurement and test equipment as well as provisions to record all test data. The procedures used in this manual are in accord with established industry practice and test laboratories should ensure that these procedures are used in the conduct of all compliance testing.

The testing done by these laboratories was not designed to be a comparison of like test procedures and like helmets, and should not be viewed as such. The testing labs arrived at different results for some tests, and like results for other tests. Tested helmets must meet performance requirements for any impact within the prescribed test area. Further, a manufacturer must certify that *all* areas within the test area meet the performance level. When laboratories test helmets, however, there could be a wide difference in the actual location on the helmet which is impacted. These different orientations of the helmets may result in different test results. The results should not be so disparate, however, that in one lab's test a particular helmet model passes and in another lab's test the same helmet model fails. In the 3,008 drops of the different laboratories reviewed by the agency, only three indicated different pass/fail results. (One of these was a failure due to the helmet liner splitting, not a failure based on actual helmet performance.) The agency considers these few disparities inconsequential.

The agency does not intend to impose an additional burden by identifying the monorail drop test equipment as the method by which it tests compliance. As stated in previous rulemakings and interpretations, a manufacturer is not required to follow specifically the test procedures identified in a particular standard. The manufacturer must, however, ascertain that the product will conform to the standard's requirements when it is tested by the specified method. In assuring itself that its product, if tested, will conform to the standard's requirements, the manufacturer must exercise due care and utilize sound engineering judgment. As a practical matter, the manufacturer may continue to use the twin wire system, so long as the manufacturer uses "due care" to ensure that performance is comparable to those tested with the monorail drop test equipment. "Due care" is determined on a case-by-case basis and whether a manufacturer's action constitutes "due care" will depend, in part, upon the availability of test equipment, the limitations of available technology, and, above all, the diligence evidenced by the manufacturer.

Information available to the agency concerning the one known manufacturer and seller of the monorail drop test equipment is filed in the Standard 218 Rulemaking Docket, including an estimated cost of $17,000 for the testing equipment and instrumentation.

Penetration Test (S7.2). The agency asked whether the geometric configuration of the pointed penetration test striker should be modified to resemble the narrow surface in the 1985 Snell standard. The Snell standard includes a penetration test which involves a non-pointed object designed to represent a common roadway obstruction.

Both Bell and Marushin indicated that they preferred the non-pointed object used in the Snell standard.

Javelin recommended that the penetration test be modified to coincide with a recommendation by Professor H.H. Hurt in his 1981 study ("Motorcycle Accident Cause Factors and Identification of Countermeasures," H.H. Hurt, J.V. Ouellet, D.R. Thom, Traffic Safety Center, University of Southern California, DOT HS-805 862, January 1981): ". . . [I]n actual accident conditions, a 90° metal edge was the much more common threat than the pointed surface of the FMVSS 218 standard penetrator .... The conical point penetrator of the current test should be replaced with a hardened steel edge approximately 1/8 inch thick and 1 inch long, in order to be representative of accident impact." (at page 325).

Javelin's comment indicated that Javelin believes that a thermoplastic helmet with thick and less dense liner and a matching shell of marginal penetration performance (according to current FMVSS 218) is a safer helmet than one with a denser liner designed to resist penetration by a pointed steel marker. The agency does not agree, since the biomechanical data available to NHTSA indicate that too thick a liner results in sustained g levels beyond the 2.0 and 4.0 milliseconds allowed by the standard. These responses would result in injuries.

Further, while the Hurt report does recommend that NHTSA adopt the Snell non-pointed object for its impact attenuation test, its general recommendations state that FMVSS 218 ". . . provides a high level of protection for the typical traffic accident, and appears to need only minor modifications." (Hurt Report, at p. 422) All of the Hurt recommendations, along with the specific comments of Bell, Javelin and Marushin will be evaluated in the context of a possible future rulemaking. The agency requests specific data in support of this change.

Metric Equivalents. The proposed rule contained metric equivalents for all inch and pound measurements, except for the headform dimensions in the Appendix. The metric equivalents in centimeters for the inch dimensions in Table 2 and Figures 6, 7, and 8 can be obtained by multiplying 2.54 to all dimensions. There were no comments on this issue, and the final rule includes metric equivalents as appropriate.

Other standards. The proposed rule asked if NHTSA should consider adopting additional requirements which are contained in other motor vehicle safety standards, for example, the Snell Memorial Foundation Standard, the American National Standards Institute (ANSI) Standard or European standards, such as the ECE standard.

Bell responded, in the affirmative. In considering the adoption of other standards' requirements in future rulemaking, the agency will need data related to performance of motorcycle helmets. The agency requests that anyone having this data submit it to NHTSA for consideration.

Other changes to final rule. In addition to the changes in response to comment, this final rule also contains certain technical, nonsubstantive changes, as described below:

General. The final rule places all of the tables and figures of the standard into one Appendix and the old Appendix is removed. This regrouping has required changes to several of the cross-references in the Standard. For example, in the definition of "Test headform," the previous reference to the old Appendix is removed and replaced with a reference to Table 2 and Figures 5 through 8.

S3 Application. The final rule adds the word "all" before the word "helmets," to clarify the Standard now applies to all helmets offered for sale in the United States, regardless of size.

S4 Definitions. The changes include placing the definitions in alphabetical order and making a cross-reference amendment of the kind described above under General changes.

S5.6 Labeling. This section is renumbered to provide consistency in the numbering scheme and to provide for numbering for the first time to undesignated paragraphs. For example, old S5.6.1(1) is now S5.6.1(a). Previously undesignated paragraphs containing instructions to the purchasers of helmets have become numbered paragraphs (1) through (4) under S5.6.1(f), Instructions to the purchasers.

Helmet position. In S6.3.1, as well as in other places where it appears, the term "prior to" has been replaced by the word "before."

S6.4 Conditioning. An additional numerical breakdown has been provided for these provisions, so that a newly designated S6.4.1 contains the conditioning requirements before testing and S6.4.2 contains conditioning requirements during testing.

S7. Test conditions.

In S7.1.4, one paragraph has been broken down into two designated paragraphs: S7.1.4(a) contains the impact attenuation free fall requirements onto the hemispherical anvil and S7.1.4(b) contains the impact attenuation free fall requirements onto the flat anvil.

In S7.1.9, the Standard requires that the acceleration data channel comply with SAE Recommended Practice J211 requirements for channel class 1,000. The proposed rule inadvertently omitted the date of the Standard. The agency intends the incorporation by reference of SAE Recommended Practice J211, Instrumentation for Impact Tests, to be to the June 1980 edition, which is substantively the same as the previously incorporated by reference 1970 edition. Accordingly, S7.1.9 has been amended to include a reference to the 1980 edition.

Costs and Benefits of FMVSS 218

In an attempt to determine the costs associated with complying with FMVSS 218, the agency posed the following questions in the NPRM. When there was a response, it immediately follows the question.

1.(a) How many helmet manufacturers have, or do not have, their own testing equipment?

Bell and Marushin indicated that they have their own testing equipment. Marushin's is twin-wire equipment.

(b) Of the manufacturers with equipment, what percentage of helmet testing is done by outside laboratories?

Marushin stated that they have an outside laboratory test helmets for calibration and comparison purposes once a year.

2.(a) How many test headforms would helmet manufacturers, who conduct their own testing, need to purchase to meet the requirements of the rule?

Bell indicated that even though they have had a complete set of headforms for several years, they have ordered a new set to ensure that they are using the same headforms as the NHTSA compliance test contractors. Marushin indicated that they already have a set, but that they will need to perform precise dimensional checks of the headforms against the requirements of the Standard to ensure continued compliance.

(b) How many manufacturers would do their own machining of the headform?

Marushin indicated that they would use a subcontractor and Bell stated their doubt that any manufacturer would do its own, even though Bell has done it in the past.

3. What are the testing costs for helmet manufacturers conducting their own testing?

Marushin estimated about $200 a helmet, while Bell stated that it was difficult to compute costs for in-house testing, since they have two full-time technicians who conduct quality control, new product research and development and competitors' model testing on a daily basis.

4. What is the cost of redesigning a motorcycle helmet shell and its liner?

Marushin estimates $50,000 and Bell indicated that the cost of redesigning a shell and liner system for a helmet varies by thousands of dollars depending on the changes made. Generally, it takes six months to a year to develop a new model and complete on-road technical testing.

5. What percent of current helmet production can be placed on the size C headform (now the medium headform)?

Marushin estimated roughly 90 percent and Bell estimated 99 percent.

6. What percent of helmet production would be tested on each of the small, medium and large headforms?

Small headform: Marushin, 10 percent; Bell, 1 percent (as the Standard is amended in this final rule.).

Medium headform: Marushin, 70 percent; Bell, 85 percent.

Large headform: Marushin, 20 percent; Bell, 14 percent.

7. What percent of helmets would need to be tested on more than one size headform?

Bell: 5 percent. (See previous discussion about required multiple testing.)

8. Is there any data comparing effectiveness of complying versus non-complying helmets?

Marushin replied that they had no data. Bell stated that "there is considerable data to indicate that helmets passing a more rigid standard in some ways, but that do not pass the DOT standard have saved many lives without any negative side effects." Bell indicated that it was referring to the time duration requirement, and that the maximum g rule is much more important than the time duration requirement, and helmets that can pass a more stringent (lower) maximum g level than FMVSS 218 may not comply with FMVSS 218 because it cannot meet the time duration requirement. The agency assumes that Bell is speaking of high-performance helmets that are designed for off-road uses, such as automobile racing, or possibly standards in existence in other countries.

Also in an attempt to estimate the costs associated with complying with FMVSS 218, the agency contracted with HH Aerospace Design Company to perform a cost/benefit study of the effects of using several headform sizes in testing motorcycle helmets. ("Cost/Benefit Study of Effects of Using Several Headform Sizes in Testing Motorcycle Helmets Under Federal Motor Vehicle Safety Standard 218," Contract No. DTNH 22-80-C-0736, Final Report, September 1980.) This report, the data submitted in response to the questions in the proposed rule, and data requested orally from companies and noted in the rulemaking docket (Docket No. 85-11) were sources used by the agency in developing a thorough analysis of this rulemaking. This analysis is part of the final regulatory evaluation prepared by the agency and can be found in the rulemaking docket of this rule (See, Final Regulatory Evaluation: Amendment Extending FMVSS 218, Motorcycle Helmets, to All Helmet Sizes, NHTSA, Plans and Policy, Office of Regulatory Analysis, July 1987.) A summary of the findings follows.

The agency has determined that there are some costs associated with this rule, since small motorcycle helmets (and any other size helmet that could not be "placed on" the size C headform) now will have to be certified as complying with FMVSS 218. The possible new costs will be in the areas of capital costs (purchase three or more new headforms, if the manufacturer does its own testing), design costs (possible redesign of liner for the small helmets, and

possibly, though considered unlikely, redesign of a motorcycle shell), testing costs (10 percent of helmet production, *i.e.*, small helmets, which could not be placed on the size C headform and previously were not subject to FMVSS 218 now will have to be tested and certified. In addition, some helmets will have to be tested on multiple test headforms if their sizing encompasses more than one headform size), and labeling costs (10 percent of helmet production will have to be labeled for the first time).

Thus, a manufacturer that intends to test its own motorcycle helmets for compliance with FMVSS 218 may have to purchase additional headforms, at a maximum estimated cost of about $4,670. In addition, a manufacturer who performs in-house compliance tests may wish to purchase the monorail drop test equipment, at an estimated cost of $17,000 (including instrumentation). Other one-time costs for manufacturers, whether or not they do in-house compliance testing, may include the redesign of noncomplying helmets. The agency anticipates that any necessary redesign will focus on liner redesign, at an estimated cost to the industry as a whole of approximately $60,000-$72,000. Although considered unlikely, there may be an instance of a manufacturer having to redesign a helmet shell. These potential costs could vary widely, with a possible cost of between $12,000 and $36,000 per shell for a redesign of a fiberglass shell and a possible cost of between $150,000 and $182,000 per shell for a redesign of a polycarbonate shell.

The other costs associated with complying with amended FMVSS 218 will be recurring costs—affecting the cost of production. Certifying the additional 10 percent of the helmets now subject to the standard will cost about $.05 per helmet; multiple testing will add approximately $.03 per helmet; and the additional labeling costs will add about $.01 per helmet.

Costs to the Consumer. The accumulated estimate of these increases is estimated to be not more than $.10 per helmet. Since helmets can range in price from $33 to $300, the agency considers this increase inconsequential.

Benefits. The agency considers there to be clear benefits to this standard. The primary benefit—the extension of test requirements to all helmet sizes—is the principal reason for undertaking the rulemaking. FMVSS 218 will now apply to all helmets, and each helmet manufacturer will have to certify each helmet model is complying with the Standard before the helmet is offered for sale in the United States. In addition, to the extent there was consumer concern about the efficacy of any helmet on the market due to a lack of universal certification, applicability of the Standard to all helmets will eliminate this concern.

Consideration of Future Action

In the NPRM, the agency asked a series of questions concerning motorcycle helmet issues that may be considered in future rulemaking proceedings. These questions elicited information on potential new areas of motorcycle helmet performance, as well as data concerning performance requirements contained in other motorcycle helmet standards, such as in the American National Standards Institute and ECE standards. The solicited information covered such issues as a different configuration for the pointed penetration test striker, enlargement of the test area of the helmet, inclusion of a chin guard performance test for full facial coverage helmets, as well as test procedure changes for the temperature conditioning requirements and dynamic testing for the retention test.

To the extent the agency received responses to these questions, they have been discussed previously, in the context of the specific issues of this rulemaking. However, the agency would like to reaffirm its interest in receiving specific data in these areas for possible future rulemaking actions. Commenters with information on these issues should refer back to the proposed rule for the specific questions on which the agency is seeking information. (See the September 27, 1985, issue of the *Federal Register*, at page 39147.) To be helpful to the agency in considering each topic, submissions must be specific, contain actual data on which the conclusions are based, and lay out test procedure specifications. If any submission is based on assumptions, please describe and justify the basis for each assumption.

Semiannual Agenda. This document appears as item number 1939 in the Department's Semiannual Regulatory Agenda, published in the *Federal Register* on April 27, 1987 (52 FR 14548, 14653; RIN #2127-AA40).

In consideration of the foregoing, Standard No. 218 is amended as follows:

S3. is revised to read as follows:

S3. *Application.* This standard applies to all helmets designed for use by motorcyclists and other motor vehicle users.

(3) S4. is amended by placing all existing definitions in alphabetical order and by revising the definitions for "Reference headform," "Reference plane," and "Test headform" to read as follows:

S4. *Definitions.*

*　　　*　　　*　　　*　　　*

"Reference headform" means a measuring device contoured to the dimensions of one of the three headforms described in Table 2 and Figures 5 through 8 with surface markings indicating the locations of the basic, mid-sagittal, and reference planes, and the centers of the external ear openings.

"Reference plane" means a plane above and parallel to the basic plane on a reference headform or test headform (Figure 2) at the distance indicated in Table 2.

*　　　*　　　*　　　*　　　*

"Test headform" means a test device contoured to the dimensions of one of the three headforms de-

scribed in Table 2 and Figures 5 through 8 with surface markings indicating the locations of the basic, mid-sagittal, and reference planes.

* * * * *

(4) S5. is revised to read as follows:

S5. *Requirements.* Each helmet shall meet the requirements of S5.1, S5.2, and S5.3 when subjected to any conditioning procedure specified in S6.4, and tested in accordance with S7.1, S7.2, and S7.3.

(5) Paragraph S5.3.1(b) is revised to read as follows:

(b) The adjustable portion of the retention system test device shall not move more than 1 inch (2.5 cm) measured between preliminary and test load positions.

(6) S5.4 is revised to read as follows:

S5.4 *Configuration.* Each helmet shall have a protective surface of continuous contour at all points on or above the test line described in S6.2.3. The helmet shall provide peripheral vision clearance of at least 105° to each side of the mid-sagittal plane, when the helmet is adjusted as specified in S6.3. The vertex of these angles, shown in Figure 3, shall be at the point on the anterior surface of the reference headform at the intersection of the mid-sagittal and basic planes. The brow opening of the helmet shall be at least 1 inch (2.5 cm) above all points in the basic plane that are within the angles of peripheral vision (see Figure 3).

(7) S5.5 is revised to read as follows:

S5.5 *Projections.* A helmet shall not have any rigid projections inside its shell. Rigid projections outside any helmet's shell shall be limited to those required for operation of essential accessories, and shall not protrude more than 0.20 inch (5 mm).

(8) S5.6 is revised to read as follows:

S5.6 *Labeling.*

S5.6.1 Each helmet shall be labeled permanently and legibly, in a manner such that the label(s) can be read easily without removing padding or any other permanent part, with the following:

(a) Manufacturer's name or identification.

(b) Precise model designation.

(c) Size.

(d) Month and year of manufacture. This may be spelled out (for example, June 1988), or expressed in numerals (for example, 6/88).

(e) The symbol DOT, constituting the manufacturer's certification that the helmet conforms to the applicable Federal motor vehicle safety standards. This symbol shall appear on the outer surface, in a color that contrasts with the background, in letters at least ⅜ inch (1 cm) high, centered laterally with the horizontal centerline of the symbol located a minimum of 1⅛ inches (2.9 cm) and a maximum of 1⅜ inches (3.5 cm) from the bottom edge of the posterior portion of the helmet.

(f) Instructions to the purchaser as follows:

(1) "Shell and liner constructed of (identify type(s) of materials)."

(2) "Helmet can be seriously damaged by some common substances without damage being visible to the user. Apply only the following: (Recommended cleaning agents, paints, adhesives, etc., as appropriate)."

(3) "Make no modifications. Fasten helmet securely. If helmet experiences a severe blow, return it to the manufacturer for inspection, or destroy it and replace it."

(4) Any additional relevant safety information should be supplied at the time of purchase by means of an attached tag, brochure, or other suitable means.

(9) S6. is revised to read as follows:

S6. *Preliminary test procedures.* Before subjecting a helmet to the testing sequence specified in S7., prepare it according to the procedures in S6.1, S6.2, and S6.3.

(10) A new S6.1 is added to read as follows:

S6.1 *Selection of appropriate headform.*

S6.1.1 A helmet with a manufacturer's designated discrete size or size range which does not exceed 6¾ (European size: 54) is tested on the small headform. A helmet with a manufacturer's designated discrete size or size range which exceeds 6¾, but does not exceed 7½ (European size: 60) is tested on the medium headform. A helmet with a manufacturer's designated discrete size or size range which exceeds 7½ is tested on the large headform.

S6.1.2 A helmet with a manufacturer's designated size range which includes sizes falling into two or all three size ranges described in S6.1.1 is tested on each headform specified for each size range.

(11) Old S6.1 is redesignated as S6.2 and is revised to read as follows:

S6.2 *Reference marking.*

S6.2.1 Use a reference headform that is firmly seated with the basic and reference planes horizontal. Place the complete helmet to be tested on the appropriate reference headform, as specified in S6.1.1 and S6.1.2.

S6.2.2 Apply a 10-pound (4.5 kg) static vertical load through the helmet's apex. Center the helmet laterally and seat it firmly on the reference headform according to its helmet positioning index.

S6.2.3 Maintaining the load and position described in S6.2.2, draw a line (hereinafter referred to as "test line") on the outer surface of the helmet coinciding with portions of the intersection of that surface with the following planes, as shown in Figure 2:

(a) A plane 1 inch (2.5 cm) above and parallel to the reference plane in the anterior portion of the reference headform;

(b) A vertical transverse plane 2.5 inches (6.4 cm) behind the point on the anterior surface of the reference headform at the intersection of the mid-sagittal and reference planes;

(c) The reference plane of the reference headform;

(d) A vertical transverse plane 2.5 inches (6.4 cm) behind the center of the external ear opening in a side view; and

(e) A plane 1 inch (2.5 cm) below and parallel to the reference plane in the posterior portion of the reference headform.

(12) Old S6.2 is redesignated as S6.3 and is revised as set forth below:

S6.3 *Helmet positioning.*

S6.3.1 Before each test, fix the helmet on a test headform in the position that conforms to its helmet positioning index. Secure the helmet so that it does not shift position before impact or before application of force during testing.

S6.3.2 In testing as specified in S7.1 and S7.2, place the retention system in a position such that it does not interfere with free fall, impact, or penetration.

(13) Old S6.3 is redesignated as 6.4 and is revised to read as follows:

S6.4 *Conditioning.*

S6.4.1 Immediately before conducting the testing sequence specified in S7, condition each test helmet in accordance with any one of the following procedures:

(a) *Ambient conditions.* Expose to a temperature of 70°F (21°C) and a relative humidity of 50 percent for 12 hours.

(b) *Low temperature.* Expose to a temperature of 14°F (−10°C) for 12 hours.

(c) *High temperature.* Expose to a temperature of 122°F (50°C) for 12 hours.

(d) *Water immersion.* Immerse in water at a temperature of 77°F (25°C) for 12 hours.

S6.4.2 If during testing, as specified in S7.1.3 and S7.2.3, a helmet is returned to the conditioning environment before the time out of that environment exceeds 4 minutes, the helmet is kept in the environment for a minimum of 3 minutes before resumption of testing with that helmet. If the time out of the environment exceeds 4 minutes, the helmet is returned to the environment for a minimum of 3 minutes for each minute or portion of a minute that the helmet remained out of the environment in excess of 4 minutes or for a maximum of 12 hours, whichever is less, before the resumption of testing with that helmet.

(14) S7.1 is revised to read as follows:

S7.1 *Impact attenuation test.*

S7.1.1 Impact attenuation is measured by determining acceleration imparted to an instrumented test headform on which a complete helmet is mounted as specified in S6.3, when it is dropped in guided free fall upon a fixed hemispherical anvil and a fixed flat steel anvil.

S7.1.2 Each helmet is impacted at four sites with two successive identical impacts at each site. Two of these sites are impacted upon a flat steel anvil and two upon a hemispherical steel anvil as specified in S7.1.10 and S7.1.11. The impact sites are at any point on the area above the test line described in paragraph S6.2.3, and separated by a distance not less than one-sixth of the maximum circumference of the helmet in the test area.

S7.1.3 Impact testing at each of the four sites, as specified in S7.1.2, shall start at 2 minutes, and be completed by 4 minutes, after removal of the helmet from the conditioning environment.

S7.1.4 (a) The guided free fall drop height for the helmet and test headform combination onto the hemispherical anvil shall be such that the minimum impact speed is 17.1 feet/second (5.2 m/sec). The minimum drop height is 54.5 inches (138.4 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses.

(b) The guided free fall drop height for the helmet and test headform combination onto the flat anvil shall be such that the minimum impact speed is 19.7 ft./sec (6.0 m/sec). The minimum drop height is 72 inches (182.9 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses.

S7.1.5 Test headforms for impact attenuation testing are constructed of magnesium alloy (K-1A), and exhibit no resonant frequencies below 2,000 Hz.

S7.1.6 The monorail drop test system is used for impact attenuation testing.

S7.1.7 The weight of the drop assembly, as specified in Table 1, is the combined weight of the test headform and the supporting assembly for the drop test. The weight of the supporting assembly is not less than 2.0 lbs. and not more than 2.4 lbs. (0.9 to 1.1 kg). The supporting assembly weight for the monorail system is the drop assembly weight minus the combined weight of the test headform, the headform's clamp down ring, and its tie down screws.

S7.1.8 The center of gravity of the test headform is located at the center of the mounting ball on the supporting assembly and lies within a cone with its axis vertical and forming a 10° included angle with the vertex at the point of impact. The center of gravity of the drop assembly lies within the rectangular volume bounded by $x = -0.25$ inch (-0.64 cm), $x = 0.85$ inch (2.16 cm), $y = 0.25$ inch (0.64 cm), and $y = -0.25$ inch (-0.64 cm) with the origin located at the center of gravity of the test headform. The rectangular volume has no boundary along the z-axis. The x-y-z axes are mutually perpendicular and have positive or negative designations in accordance with the right-hand rule (See Figure 5). The origin of the coordinate axes also is located at the center of the mounting ball on the supporting assembly (See Figures 6, 7, and 8). The x-y-z axes of the test headform assembly on a monorail drop test equipment are oriented as follows: From the origin, the x-axis is horizontal with its positive direction going toward and passing through the vertical centerline of the monorail. The positive z-axis is downward. The y-axis also is horizontal and its direction can be decided by the z- and x-axes, using the right-hand rule.

S7.1.9 The acceleration transducer is mounted at the center of gravity of the test headform with the sensitive axis aligned to within 5° of vertical when the test headform assembly is in the impact position. The acceleration data channel complies with SAE Recommended Practice J211 JUN 80, Instrumentation for Impact Tests, requirements for channel class 1,000.

S7.1.10 The flat anvil is constructed of steel with a 5-inch (12.7 cm) minimum diameter impact face, and the hemispherical anvil is constructed of steel with a 1.9 inch (4.8 cm) radius impact face.

S7.1.11 The rigid mount for both of the anvils consists of a solid mass of at least 300 pounds (136.1 kg), the outer surface of which consists of a steel plate with minimum thickness of 1 inch (2.5 cm) and minimum surface area of 1 ft^2 (929 cm^2).

S7.1.12 The drop system restricts side movement during the impact attenuation test so that the sum of the areas bounded by the acceleration-time response curves for both the x- and y-axes (horizontal axes) is less than five percent of the area bounded by the acceleration-time response curve for the vertical axis.

(15) S7.2 is revised as set forth below:

S7.2 *Penetration test.*

S7.2.1 The penetration test is conducted by dropping the penetration test striker in guided free fall, with its axis aligned vertically, onto the outer surface of the complete helmet, when mounted as specified in S6.3, at any point above the test line, described in S6.2.3, except on a fastener or other rigid projection.

S7.2.2 Two penetration blows are applied at least 3 inches (7.6 cm) apart, and at least 3 inches (7.6 cm) from the centers of any impacts applied during the impact attenuation test.

S7.2.3 The application of the 2 penetration blows, specified in S7.2.2, starts at 2 minutes and is completed by 4 minutes, after removal of the helmet from the conditioning environment.

S7.2.4 The height of the guided free fall is 118.1 inches (3 m), as measured from the striker point to the impact point on the outer surface of the test helmet.

S7.2.5 The contactable surface of the penetration test headform is constructed of a metal or metallic alloy having a Brinell hardness number no greater than 55, which will permit ready detection should contact by the striker occur. The surface is refinished if necessary before each penetration test blow to permit detection of contact by the striker.

S7.2.6 The weight of the penetration striker is 6 pounds, 10 ounces (3 kg).

S7.2.7 The point of the striker has an included angle of 60°, a cone height of 1.5 inches (3.8 cm), a tip radius of 0.02 inch (standard 0.5 millimeter radius) and a minimum hardness of 60 Rockwell, C-scale.

S7.2.8 The rigid mount for the penetration test headform is as described in S7.1.11.

(16) S7.3 is revised to read as follows:

S7.3 *Retention system test.*

S7.3.1 The retention system test is conducted by applying a static tensile load to the retention assembly of a complete helmet, which is mounted, as described in S6.3, on a stationary test headform as shown in Figure 4, and by measuring the movement of the adjustable portion of the retention system test device under tension.

S7.3.2 The retention system test device consists of both an adjustable loading mechanism by which a static tensile load is applied to the helmet retention assembly and a means for holding the test headform and helmet stationary. The retention assembly is fastened around two freely moving rollers, both of which have a 0.5 inch (1.3 cm) diameter and a 3-inch (7.6 cm) center-to-center separation, and which are mounted on the adjustable portion of the tensile loading device (Figure 4). The helmet is fixed on the test headform as necessary to ensure that it does not move during the application of the test loads to the retention assembly.

S7.3.3 A 50-pound (22.7 kg) preliminary test load is applied to the retention assembly, normal to the basic plane of the test headform and symmetrical with respect to the center of the retention assembly for 30 seconds, and the maximum distance from the extremity of adjustable portion of the retention system test device to the apex of the helmet is measured.

S7.3.4 An additional 250-pound (113.4 kg) test load is applied to the retention assembly, in the same manner and at the same location as described in S7.3.3, for 120 seconds, and the maximum distance from the extremity of adjustable portion of the retention system test device to the apex of the helmet is measured.

(17) The old Appendix to §571.218 is removed, existing Figures 1, 2, 3, and 4 and Table 1 of Standard 218 are moved so that they are contained within a new Appendix to §571.218, and Figure 2 and Table 1 are revised, and new Figures 5, 6, 7, 8 and Table 2 are added as set forth below:

Table 1.—Weights for Impact Attenuation Test Drop Assembly

Test headform size	Weight[1]—lb (kg)
Small	7.8 lb (3.5 kg)
Medium	11.0 lb (5.0 kg)
Large	13.4 lb (6.1 kg)

[1]Combined weight of instrumented test headform and supporting and assembly for drop test.

Issued on March 31, 1988.

Diane K. Steed
Administrator

53 F.R. 11280
April 6, 1988

Appendix

Table 1.

Weights for Impact Attenuation Test Drop Assembly

Test Headform Size	Weight[1] — 1 lb(kg)
Small	7.8 (3.5 kg)
Medium	11.0 (5.0 kg)
Large	13.4 (6.1 kg)

[1]Combined weight of instrumented test headform and supporting assembly for drop test.

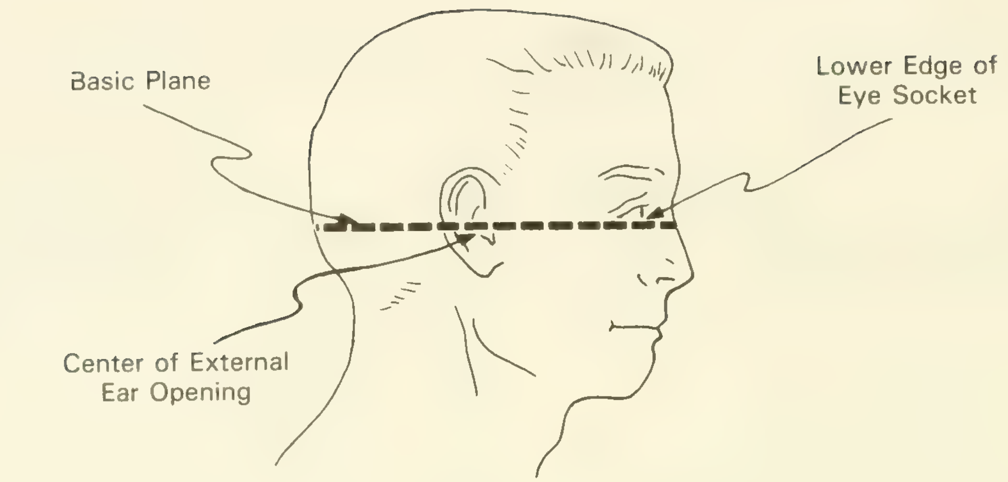


Figure 1.

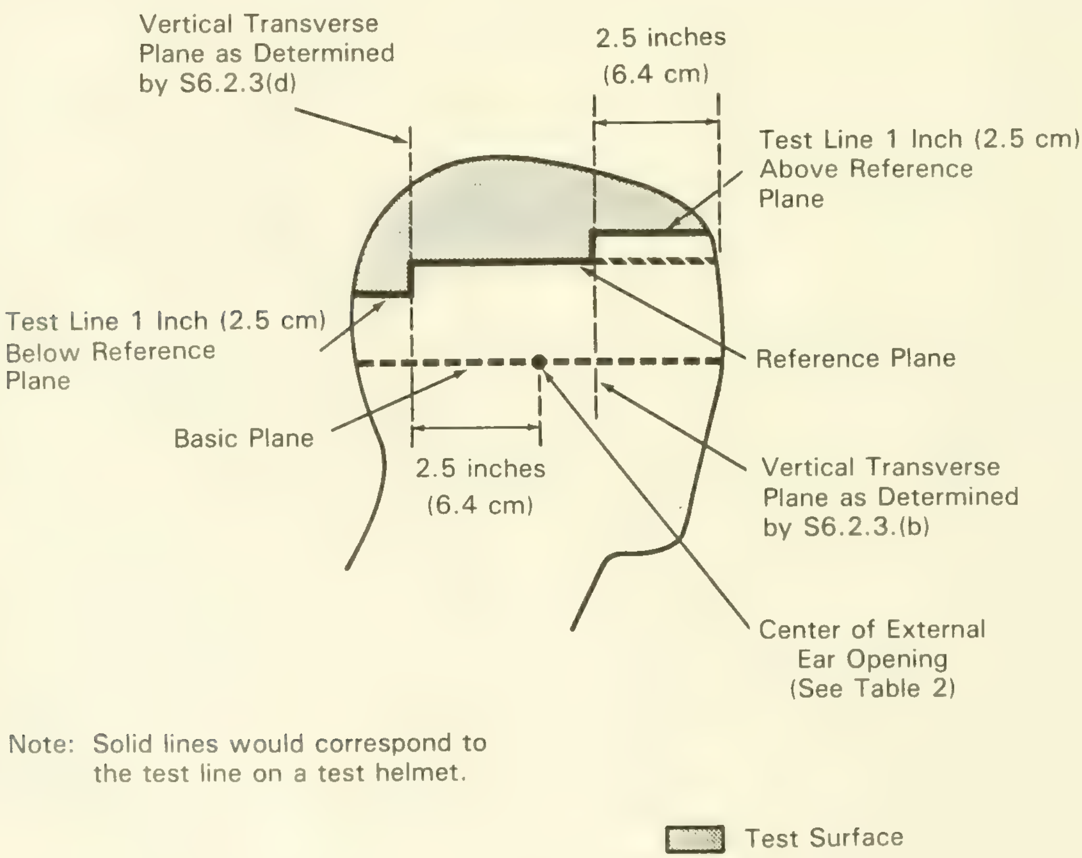


Figure 2.

Section Through the Basic Plane

Top View

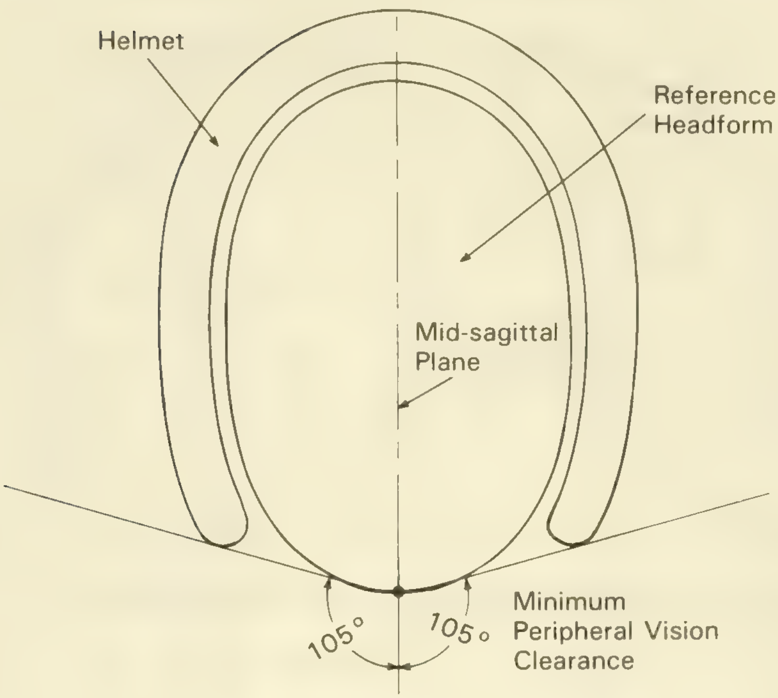
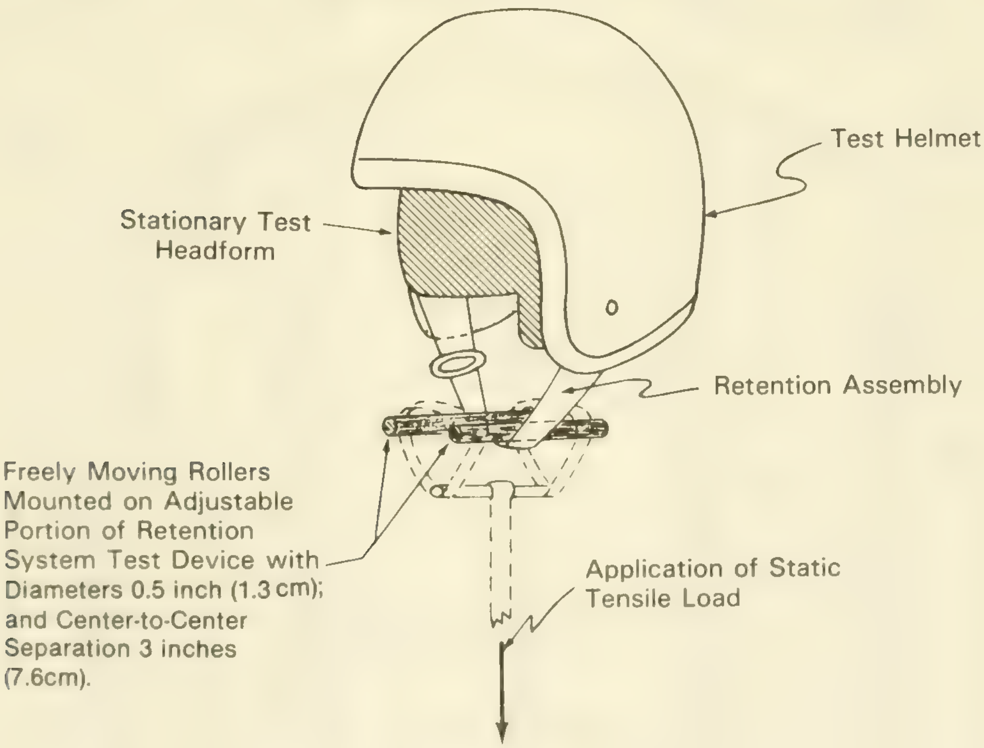
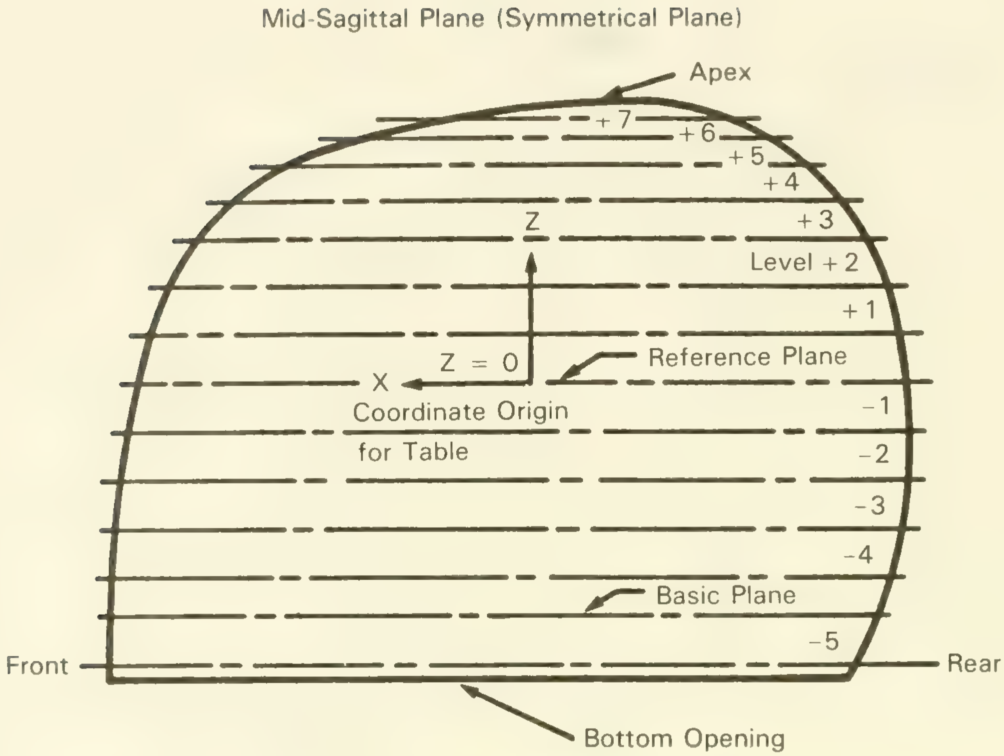


Figure 3.



Retention System Test Device

Figure 4.



Headform Coordinate Systems
(Right-hand Rule)

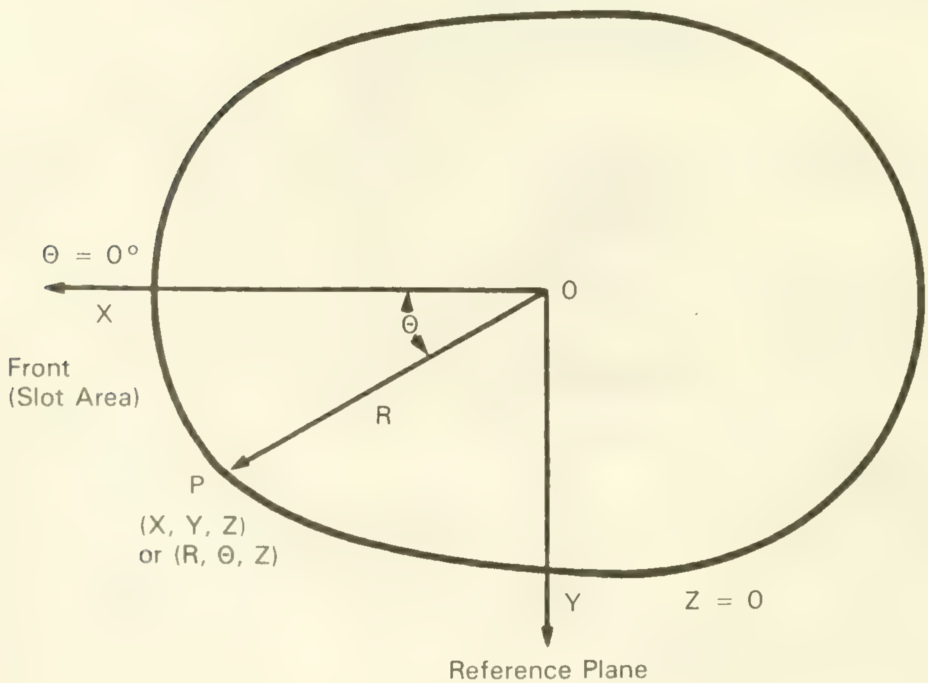


Figure 5. Headform Sections

Table 2

Medium Headform — Exterior Dimensions

Θ	Bottom Opening Z= -3.02			Level—5 Z= -2.900		
	R	X	Y	R	X	Y
0	4.292	4.292	0	4.293	4.293	0
10	4.266	4.201	0.741	4.270	4.205	0.742
20	4.159	3.908	1.423	4.172	3.920	1.427
30	3.967	3.436	1.984	3.961	3.430	1.981
40	3.660	2.804	2.353	3.670	2.811	2.359
50	3.332	2.142	2.553	3.352	2.155	2.568
60	3.039	1.520	2.632	3.067	1.534	2.656
70	2.839	0.971	2.668	2.869	0.981	2.696
80	2.720	0.472	2.679	2.772	0.481	2.730
90	2.675	0	2.675	2.709	0	2.709
100	2.703	−0.469	2.662	2.724	−0.473	2.683
110	2.764	−0.945	2.597	2.794	−0.956	2.626
120	2.888	−1.444	2.501	2.917	−1.459	2.526
130	2.985	−1.919	2.287	3.040	−1.954	2.329
140	3.100	−2.375	1.993	3.175	−2.432	2.041
150	3.175	−2.750	1.588	3.232	−2.799	1.616
160	3.186	−2.994	1.090	3.246	−3.050	1.110
170	3.177	−3.129	0.552	3.237	−3.188	0.562
180	3.187	−3.187	0	3.246	−3.246	0

Θ	Basic Plane Z= -2.360			Level—4 Z= -2.000		
	R	X	Y	R	X	Y
0	4.272	4.272	0	4.247	4.247	0
10	4.248	4.184	0.738	4.223	4.159	0.733
20	4.147	3.897	1.418	4.120	3.872	1.409
30	3.961	3.430	1.981	3.940	3.412	1.970
40	3.687	2.824	2.370	3.683	2.821	2.367
50	3.384	2.175	2.592	3.392	2.180	2.598
60	3.111	1.556	2.694	3.132	1.566	2.712
70	2.927	1.001	2.751	2.960	1.012	2.782
80	2.815	0.489	2.772	2.860	0.497	2.817
90	2.779	0	2.779	2.838	0	2.838
100	2.802	−0.487	2.759	2.861	−0.497	2.818
110	2.887	−0.987	2.713	2.958	−1.012	2.780
120	3.019	−1.510	2.615	3.098	−1.549	2.683
130	3.180	−2.044	2.436	3.260	−2.096	2.497
140	3.306	−2.533	2.125	3.405	−2.608	2.189
150	3.398	−2.943	1.699	3.516	−3.045	1.758
160	3.458	−3.250	1.183	3.585	−3.369	1.226
170	3.475	−3.422	0.603	3.612	−3.557	0.627
180	3.472	−3.472	0	3.609	−3.609	0

Table 2

Medium Headform — Exterior Dimensions (Continued)

Θ	Level—3 Z= -1.500			Level—2 Z= -1.000		
	R	X	Y	R	X	Y
0	4.208	4.208	0	4.148	4.148	0
10	4.179	4.116	0.726	4.112	4.050	0.714
20	4.075	3.829	1.394	4.013	3.771	1.373
30	3.902	3.379	1.951	3.844	3.329	1.922
40	3.654	2.799	2.349	3.609	2.765	2.320
50	3.377	2.171	2.587	3.352	2.155	2.568
60	3.094	1.547	2.680	3.137	1.569	2.717
70	2.982	1.020	2.802	2.989	1.022	2.809
80	2.891	0.502	2.847	2.902	0.504	2.858
90	2.876	0	2.876	2.884	0	2.884
100	2.918	−0.507	2.874	2.943	−0.511	2.898
110	3.021	−1.033	2.839	3.052	−1.044	2.868
120	3.170	−1.585	2.745	3.225	−1.613	2.793
130	3.337	−2.145	2.556	3.397	−2.184	2.602
140	3.483	−2.668	2.239	3.536	−2.709	2.273
150	3.604	−3.121	1.802	3.657	−3.167	1.829
160	3.682	−3.460	1.259	3.751	−3.525	1.283
170	3.725	−3.668	0.647	3.807	−3.749	0.661
180	3.741	−3.741	0	3.822	−3.822	0

Θ	Level—1 Z= −0.500			Reference Plane Z=0.0		
	R	X	Y	R	X	Y
0	4.067	4.067	0	3.971	3.971	0
10	4.033	3.972	0.700	3.935	3.875	0.683
20	3.944	3.706	1.349	3.853	3.621	1.318
30	3.777	3.271	1.889	3.701	3.205	1.851
40	3.552	2.721	2.283	3.491	2.674	2.244
50	3.323	2.136	2.546	3.279	2.108	2.512
60	3.126	1.563	2.707	3.101	1.551	2.686
70	2.987	1.022	2.807	2.979	1.019	2.799
80	2.912	0.506	2.868	2.910	0.505	2.866
90	2.893	0	2.893	2.890	0	2.890
100	2.895	−0.503	2.851	2.945	−0.511	2.900
110	3.064	−1.048	2.879	3.062	−1.047	2.877
120	3.231	−1.616	2.798	3.228	−1.614	2.796
130	3.411	−2.193	2.613	3.413	−2.194	2.615
140	3.560	−2.727	2.288	3.563	−2.729	2.290
150	3.682	−3.189	1.841	3.681	−3.188	1.841
160	3.783	−3.555	1.294	3.773	−3.546	1.290
170	3.885	−3.826	0.675	3.832	−3.774	0.665
180	3.857	−3.857	0	3.844	−3.844	0

Table 2

Medium Headform — Exterior Dimensions (Continued)

Θ	Level+1 Z=0.500			Level +2 Z=1.000		
	R	X	Y	R	X	Y
0	3.830	3.830	0	3.665	3.665	0
10	3.801	3.743	0.660	3.613	3.558	0.627
20	3.725	3.500	1.274	3.554	3.340	1.216
30	3.587	3.106	1.794	3.436	2.976	1.718
40	3.399	2.604	2.185	3.271	2.506	2.103
50	3.205	2.060	2.455	3.102	1.994	2.376
60	3.044	1.522	2.636	2.959	1.480	2.563
70	2.927	1.001	2.751	2.854	0.976	2.682
80	2.861	0.497	2.818	2.792	0.485	2.750
90	2.855	0	2.855	2.783	0	2.783
100	2.897	−0.503	2.853	2.832	−0.492	2.789
110	3.007	−1.029	2.826	2.938	−1.005	2.761
120	3.176	−1.588	2.751	3.102	−1.551	2.686
130	3.372	−2.168	2.583	3.294	−2.117	2.523
140	3.520	−2.697	2.263	3.450	−2.643	2.218
150	3.643	−3.155	1.822	3.564	−3.087	1.782
160	3.728	−3.503	1.275	3.637	−3.418	1.244
170	3.777	−3.720	0.656	3.675	−3.619	0.638
180	3.782	−3.782	0	3.670	−3.670	0

Θ	Level +3 Z=1.450			Level +4 Z=1.860		
	R	X	Y	R	X	Y
0	3.419	3.419	0	3.061	3.061	0
10	3.382	3.331	0.587	3.035	2.989	0.527
20	3.299	3.100	1.128	2.966	2.787	1.014
30	3.197	2.769	1.599	2.872	2.487	1.436
40	3.052	2.338	1.962	2.754	2.110	1.770
50	2.911	1.871	2.230	2.642	1.698	2.024
60	2.786	1.393	2.413	2.522	1.261	2.184
70	2.700	0.924	2.537	2.477	0.847	2.328
80	2.647	0.460	2.607	2.442	0.424	2.405
90	2.636	0	2.636	2.442	0	2.442
100	2.691	−0.467	2.650	2.492	−0.433	2.454
110	2.796	−0.956	2.627	2.599	−0.889	2.442
120	2.961	−1.481	2.564	2.758	−1.379	2.389
130	3.147	−2.023	2.411	2.936	−1.887	2.249
140	3.301	−2.529	2.122	3.081	−2.360	1.980
150	3.408	−2.951	1.704	3.176	−2.751	1.588
160	3.479	−3.269	1.190	3.230	−3.035	1.105
170	3.514	−3.461	0.610	3.270	−3.220	0.568
180	3.502	−3.502	0	3.271	−3.271	0

Table 2

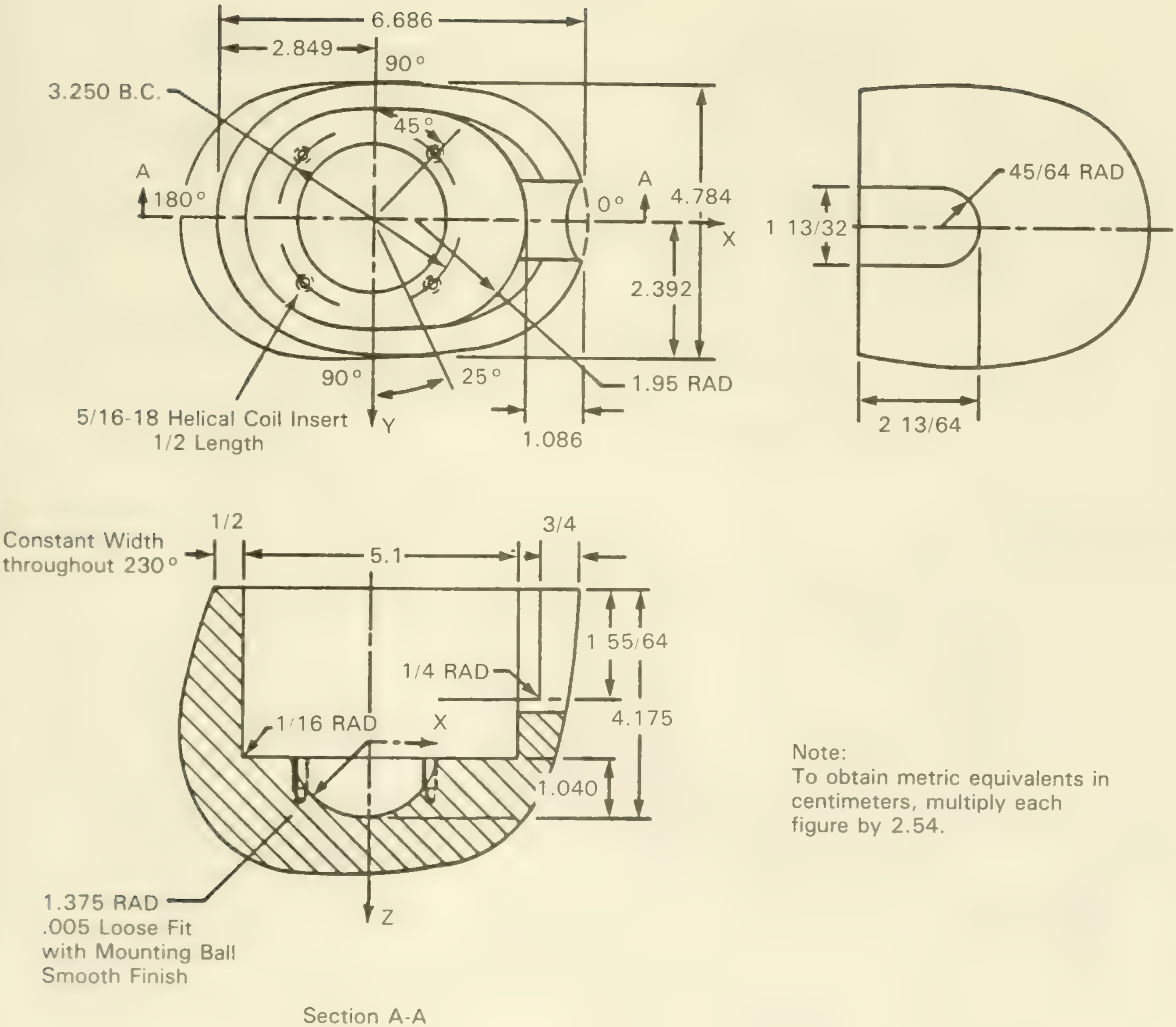
Medium Headform — Exterior Dimensions (Continued)

Θ	Level +5 Z=2.250			Level +6 Z=2.560		
	R	X	Y	R	X	Y
0	2.526	2.526	0	1.798	1.798	0
10	2.521	2.483	0.483	1.798	1.771	0.312
20	2.464	2.315	0.843	1.757	1.651	0.601
30	2.387	2.067	1.194	1.719	1.489	0.860
40	2.305	1.766	1.482	1.678	1.285	1.079
50	2.232	1.435	1.710	1.652	1.062	1.266
60	2.174	1.087	1.883	1.641	0.821	1.421
70	2.144	0.733	2.015	1.645	0.563	1.546
80	2.132	0.370	2.100	1.673	0.291	1.648
90	2.147	0	2.147	1.712	0	1.712
100	2.213	−0.384	2.179	1.809	−0.314	1.782
110	2.316	−0.792	2.176	1.925	−0.658	1.809
120	2.463	−1.232	2.133	2.066	−1.033	1.789
130	2.624	−1.687	2.010	2.213	−1.423	1.695
140	2.763	−2.117	1.776	2.358	−1.806	1.516
150	2.863	−2.479	1.432	2.469	−2.138	1.235
160	2.919	−2.743	0.988	2.536	−2.383	0.867
170	2.954	−2.909	0.513	2.561	−2.522	0.445
180	2.958	−2.958	0	2.556	−2.556	0

Θ	Level +7 Z=2.750		
	R	X	Y
0	1.081	1.081	0
10	1.088	1.072	0.189
20	1.055	0.991	0.361
30	1.039	0.900	0.520
40	1.039	0.796	0.668
50	1.052	0.676	0.806
60	1.068	0.534	0.925
70	1.106	0.378	1.039
80	1.171	0.203	1.153
90	1.242	0	1.242
100	1.422	−0.247	1.400
110	1.489	−0.509	1.399
120	1.683	−0.842	1.458
130	1.801	−1.158	1.380
140	1.954	−1.497	1.256
150	2.083	−1.804	1.042
160	2.138	−2.009	0.731
170	2.175	−2.142	0.378
180	2.175	−2.175	0

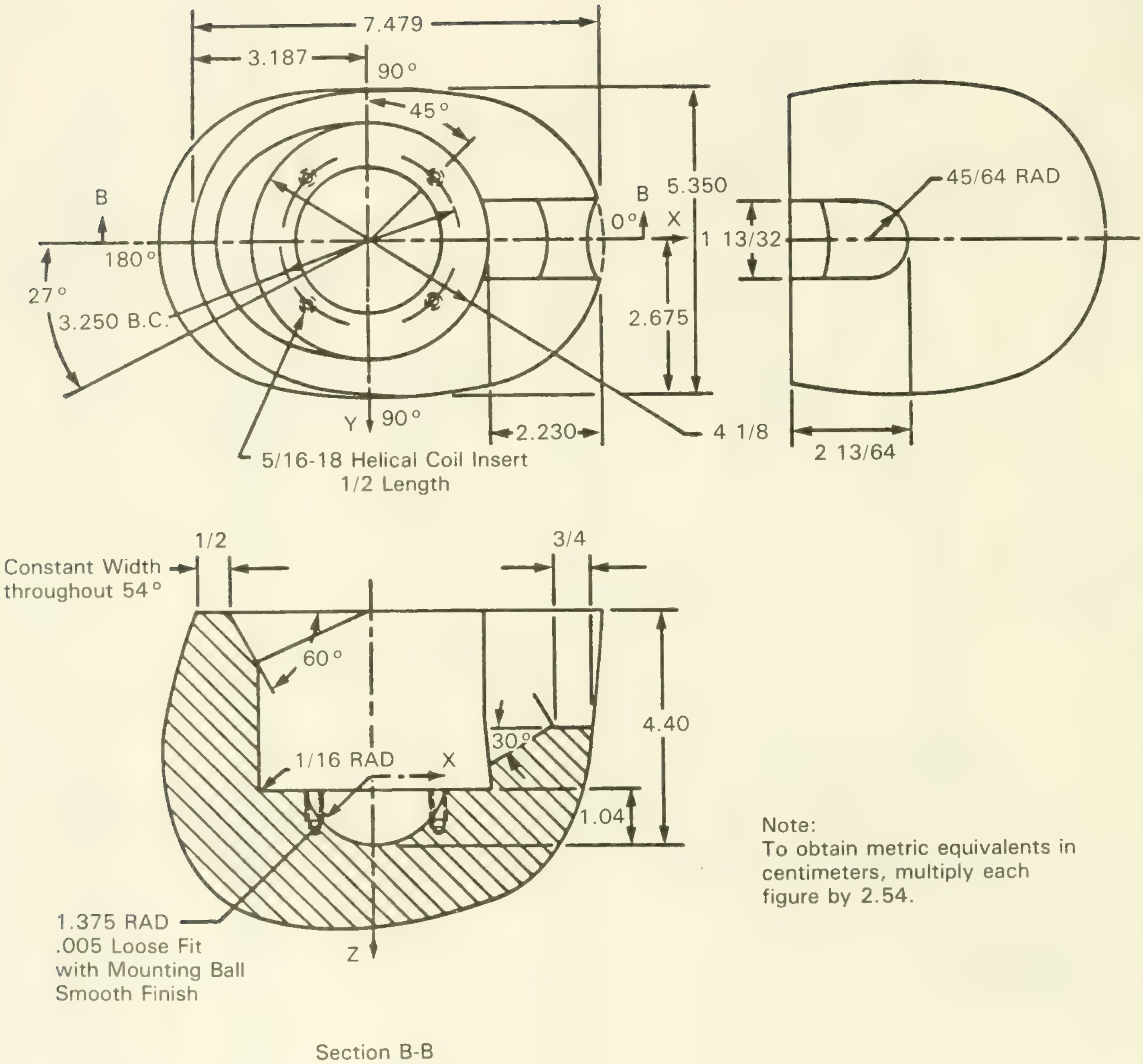
Notes:

1. Apex is located at (-0.75, 0, 3.02) for (X,Y,Z) or (0.75, 180, 3.02) for (R, Θ, Z).
2. Center of ear opening is located at (0.40, 2.78, -2.36) for (X,Y,Z) or (2.80, 81.8, -2.36) for (R,Θ,Z).
3. Scale all dimensions by 0.8941 for small headform.
4. Scale all dimensions by 1.069 for large headform.
5. Headform is symmetrical about the mid-sagittal plane.
6. Units:
   R,X,Y,Z — inches.
   Θ — degrees.
7. To obtain metric equivalents in centimeters, multiply each figure by 2.54.



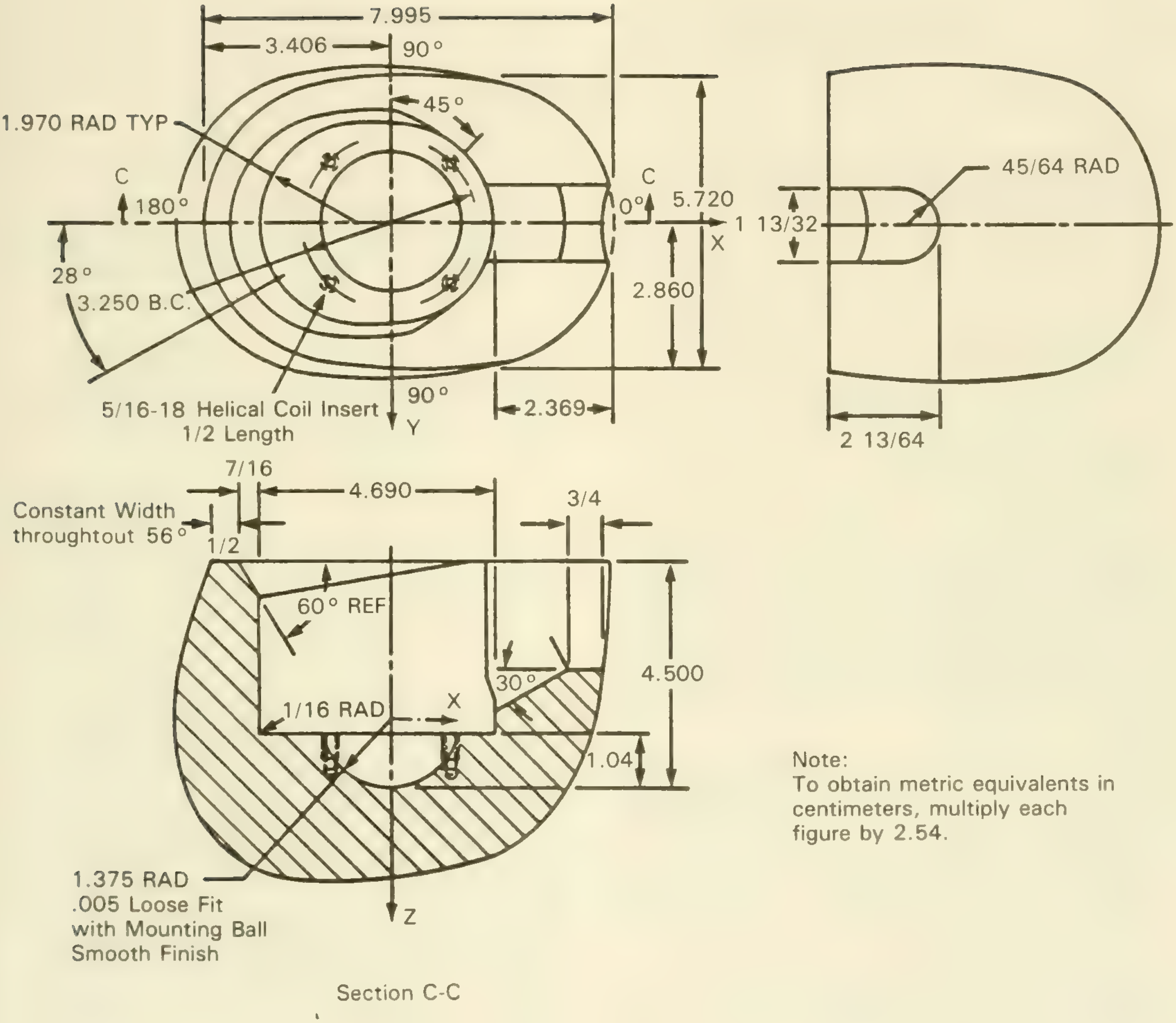
Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 6. Small Headform — Interior Design



Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 7. Medium Headform — Interior Design



Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 8. Large Headform – Interior Design

MOTOR VEHICLE SAFETY STANDARD NUMBER 218

Motorcycle Helmets

(Docket No. 72-6; Notice 2)

S1. Scope.

This standard establishes minimum performance requirements for helmets designed for use by motorcyclists and other motor vehicle users.

S2. Purpose.

The purpose of this standard is to reduce deaths and injuries to motorcyclists and other motor vehicle users resulting from head impacts.

S3. Application.

This standard applies to [all] helmets designed for use by motorcyclists and other motor vehicle users.

S4. Definitions.

"Basic plane" means a plane through the centers of the right and left external ear openings and the lower edge of the eye sockets (Figure 1) of a reference headform (Figure 2) or test headform.

"Helmet positioning index" means the distance in inches, as specified by the manufacturer, from the lowest point of the brow opening at the lateral midpoint of the helmet to the basic plane of a reference headform, when the helmet is firmly and properly positioned on the reference headform.

"Midsagittal plane" means a longitudinal plane through the apex of a reference headform or test headform that is perpendicular to the basic plane (Figure 3).

["Reference headform" means a measuring device contoured to the dimensions of one of the three headforms described in Table 2 and Figures 5 through 8 with surface markings indicating the locations of the basic, mid-sagittal, and reference planes, and the centers of the external ear openings.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

["Reference plane" means a plane above and parallel to the basic plane on a reference headform or test headform (Figure 2) at the distance indicated in Table 2.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

"Retention system" means the complete assembly by which the helmet is retained in position on the head during use.

["Test headform" means a test device contoured to the dimensions of one of the three headforms described in Table 2 and Figures 5 through 8 with surface markings indicating the locations of the basic, mid-sagittal, and reference planes.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S5. Requirements.

[Each helmet shall meet the requirements of S5.1, S5.2, and S5.3 when subjected to any conditioning procedure specified in S6.4, and tested in accordance with S7.1, S7.2, and S7.3.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S5.1 Impact attenuation. When an impact attenuation test is conducted in accordance with S7.1, all of the following requirements shall be met:

(a) Peak accelerations shall not exceed 400g;

(b) [Accelerations in excess of 200g shall not exceed a cumulative duration of 2.0 milliseconds; and]

(c) Accelerations in excess of 150g shall not exceed a cumulative duration of 4.0 milliseconds.

S5.2 Penetration. When a penetration test is conducted in accordance with S7.2, the striker shall not contact the surface of the test headform.

S5.3 Retention system.

S5.3.1 When tested in accordance with S7.3:

(a) The retention system or its components shall attain the loads specified without separation; and

(b) The adjustable portion of the retention system test device shall not move more than 1 inch (2.5 cm) measured between preliminary and test load positions.

S5.3.2 Where the retention system consists of components which can be independently fastened without securing the complete assembly, each such component shall independently meet the requirements of S5.3.1.

S5.4 Configuration. Each helmet shall have a protective surface of continuous contour at all points on or above the test line described in [S6.2.3.] The helmet shall provide peripheral vision clearance of at least 105° to each side of the mid-sagittal plane, when the helmet is adjusted as specified in [S6.3.] The vertex of these angles, shown in Figure 3, shall be at the point on the anterior surface of the reference headform at the intersection of the mid-sagittal and basic planes. The brow opening of the helmet shall be at least 1 inch [(2.5cm)] above all points in the basic plane that are within the angles of peripheral vision (see Figure 3).

S5.5 Projections. A helmet shall not have any rigid projections inside its shell. Rigid projections outside any helmet's shell shall be limited to those required for operation of essential accessories, and shall not protrude more than [0.20 inch (5mm)].

S5.6 Labeling.

S5.6.1 Each helmet shall be labeled permanently and legibly, in a manner such that the label(s) can be read easily without removing padding or any other permanent part, with the following:

(a) Manufacturer's name or identification.

(b) Precise model designation.

(c) Size.

(d) Month and year of manufacture. This may be spelled out (for example, June 1988), or expressed in numerals (for example, 6/88).

(e) The symbol DOT, constituting the manufacturer's certification that the helmet conforms to the applicable Federal Motor Vehicle Safety Standards. This symbol shall appear on the outer surface, in a color that contrasts with the background, in letters at least ⅜ inch [(1 cm) high, centered laterally with the horizontal centerline of the symbol located a minimum of 1⅛ inches (2.9 cm) and a maximum of 1⅜ inches (3.5 cm) from the bottom edge of the posterior portion of the helmet.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

[(f) Instructions to the purchaser as follows:

(1) "Shell and liner constructed of (identify type(s) of materials)."

(2) "Helmet can be seriously damaged by some common substances without damage being visible to the user. Apply only the following: (Recommended cleaning agents, paints, adhesives, etc., as appropriate)."

(3) "Make no modifications. Fasten helmet securely. If helmet experiences a severe blow, return it to the manufacturer for inspection, or destroy it and replace it."

(4) Any additional relevant safety information should be supplied at the time of purchase by means of an attached tag, brochure, or other suitable means.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S5.7 Helmet positioning index. Each manufacturer of helmets shall establish a positioning index for each helmet he manufactures. This index shall be furnished immediately to any person who requests the information, with respect to a helmet identified by manufacturer, model designation, and size.

S6. Preliminary test procedures. Before subjecting a helmet to the testing sequence specified in S7., prepare it according to the following procedures [S6.1, S6.2, and S6.3].

[S6.1 Selection of appropriate headform.

S6.1.1 A helmet with a manufacturer's designated discrete size or size range which does

not exceed 6 3/4 (European size: 54) is tested on the small headform. A helmet with a manufacturer's designated discrete size or size range which exceeds 6 3/4, but does not exceed 7 1/2 (European size: 60) is tested on the medium headform. A helmet with a manufacturer's designated discrete size or size range which exceeds 7 1/2 is tested on the large headform.

S6.1.2 A helmet with a manufacturer's designated size range which includes sizes falling into two or all three size ranges described in S6.1.1 is tested on each headform specified for each size range.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

[S6.2 Reference marking.

S6.2.1 Use a reference headform that is firmly seated with the basic and reference planes horizontal. Place the complete helmet to be tested on the appropriate reference headform, as specified in S6.1.1 and S6.1.2.

S6.2.2 Apply a 10-pound (4.5 kg) static vertical load through the helmet's apex. Center the helmet laterally and seat it firmly on the reference headform according to its helmet positioning index.

S6.2.3 Maintaining the load and position described in S6.2.2, draw a line (hereinafter referred to as "test line") on the outer surface of the helmet coinciding with portions of the intersection of that surface with the following planes, as shown in Figure 2:

(a) A plane 1 inch (2.5 cm) above and parallel to the reference plane in the anterior portion of the reference headform;

(b) A vertical transverse plane 2.5 inches (6.4 cm) behind the point on the anterior surface of the reference headform at the intersection of the mid-sagittal and reference planes;

(c) The reference plane of the reference headform;

(d) A vertical transverse plane 2.5 inches (6.4 cm) behind the center of the external ear opening in a side view; and

(e) A plane 1 (2.5 cm) inch below and parallel to the reference plane in the posterior portion of the reference headform.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S6.3 Helmet positioning.

S6.3.1 Before each test, fix the helmet on a test headform in the position that conforms to its helmet positioning index. Secure the helmet so that it does not shift position before impact or before application of force during testing.

[S6.3.2] In testing as specified in S7.1 and S7.2, place the retention system in a position such that it does not interfere with free fall, impact, or penetration.

S6.4 Conditioning.

S6.4.1 Immediately before conducting the testing sequence specified in S7., condition each test helmet in accordance with any one of the following procedures:

(a) *Ambient conditions.* Expose to a temperature of 70° F. [(21°C)] and a relative humidity of 50% for 12 hours.

(b) *Low temperature.* Expose to a temperature of 14° F. [(−10°C)] for 12 hours.

(c) *High temperature.* Expose to a temperature of 122° F. [(50° C)]for 12 hours.

(d) *Water immersion.* Immerse in water at a temperature of 77° F. [(25° C)] for 12 hours.

S6.4.2 If during testing, as specified in S7.1.3 and S7.2.3, a helmet is returned to the conditioning environment before the time out of that environment exceeds 4 minutes, the helmet is kept in the environment for a minimum of 3 minutes before resumption of testing with that helmet. If the time out of the environment exceeds 4 minutes, the helmet is returned to the environment for a minimum of 3 minutes for each minute or portion of a minute that the helmet remained out of the environment in excess of 4 minutes or for a maximum of 12 hours, whichever is less, before the resumption of testing with than helmet.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S7. Test conditions.

S7.1 Impact attenuation test.

S7.1.1 Impact attenuation is measured by determining acceleration imparted to an instrumented test headform on which a complete helmet is mounted as specified in [S6.3], when it is dropped in guided free fall upon a fixed hemispherical anvil and a fixed flat steel anvil.

S7.1.2 Each helmet is impacted at four sites with two successive, identical impacts at each site. Two of these sites are impacted upon a flat steel anvil and two upon a hemispherical steel anvil as specified in [S7.1.10] and [S7.1.11]. The impact sites are at any point on the area above the test line described in [S6.2.3], and separated by a distance not less than one-sixth of the maximum circumference of the helmet [in the test area].

S7.1.3 [Impact testing at each of the four sites, as specified in S7.1.2, shall start at two minutes, and be completed by four minutes, after removal of the helmet from the conditioning environment.

S7.1.4 (a) The guided free fall drop height for the helmet and test headform combination onto the hemispherical anvil shall be such that the minimum impact speed is 17.1 feet/second (5.2 m/sec). The minimum drop height is 54.5 inches (138.4 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses.

(b) The guided free fall drop height for the helmet and test headform combination onto the flat anvil shall be such that the minimum impact speed is 19.7 ft/sec. (6.0 m/sec). The minimum drop height is 72 inches (182.9 cm). The drop height is adjusted upward from the minimum to the extent necessary to compensate for friction losses.

S7.1.5 Test headforms for impact attenuation testing are constructed of magnesium alloy (K-1A), and exhibit no resonant frequencies below 2,000 Hz.

S7.1.6 The monorail drop test system is used for impact attenuation testing.

S7.1.7 The weight of the drop assembly, as specified in Table 1, is the combined weight of the test headform and the supporting assembly for the drop test. The weight of the supporting assembly is not less than 2.0 lbs. and not more than 2.4 lbs. (0.9 to 1.1 kg). The supporting assembly weight for the monorail system is the drop assembly weight minus the combined weight of the test headform, the headform's clamp down ring, and its tie down screws.

S7.1.8 The center of gravity of the test headform is located at the center of the mounting ball on the supporting assembly and lies within a cone with its axis vertical and forming and 10° included angle with the vertex at the point of impact. The center of gravity of the drop assembly lies with the rectangular volume bounded by $x = -0.25$ inch (-0.64 cm), $x = 0.85$ inch (2.16 cm), $y = 0.25$ inch (0.64 cm), and $y = -0.25$ inch (-0.64 cm) with the origin located at the center of gravity of the test headform. The rectangular volume has no boundary along the z-axis. The x-y-z axes are mutually perpendicular and have positive or negative designations in accordance with the right-hand rule (See Figure 5). The origin of the coordinate axes also is located at the center of the mounting ball on the supporting assembly (See Figures 6, 7, and 8). The x-y-z axes of the test headform assembly on a monorail drop test equipment are oriented as follows: From the origin, the x-axis is horizontal with its positive direction going toward and passing through the vertical centerline of the monorail. The positive z-axis is downward. The y-axis also is horizontal and its direction can be decided by the z- and x-axes, using the right-hand rule.

S7.1.9 The acceleration transducer is mounted at the center of gravity of the test headform with the sensitive axis aligned to within 5° of vertical when the test headform assembly is in the impact position. The acceleration data channel complies with *SAE Recommended Practice J211 JUN 80, Instrumentation for Impact Tests, requirements for channel class 1,000.*

S7.1.10 The flat anvil is constructed of steel with a 5-inch (12.7 cm) minimum diameter impact face, and the hemispherical anvil is constructed of steel with a 1.9 inch (4.8 cm) radius impact face.

S7.1.11 The rigid mount for both of the anvils consists of a solid mass of at least 300 pounds (136.1 kg), the outer surface of which consists of a steel plate with minimum thickness of 1 inch (2.5 cm) and minimum surface area of 1 ft^2 (929 cm^2).

S7.1.12 The drop system restricts side movement during the impact attenuation test so that the sum of the areas bounded by the acceleration-time response curves for both the x- and y-axes (horizontal axes) is less than five percent of the

area bounded by the acceleration-time response curve for the vertical axis.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

S7.2 Penetration test.

S7.2.1. The penetration test is conducted by dropping the penetration test striker in guided free fall, with its axis aligned vertically, onto the outer surface of the complete helmet, when mounted as specified in [S6.3], at any point above the test line, described in [S6.2.3], except on a fastener or other rigid projection.

S7.2.2 Two penetration blows are applied at least 3 inches [(7.6 cm)] apart, and at least 3 inches [(7.6 cm)] from the centers of any impacts applied during the impact attenuation test.

[S7.2.3 The application of the two penetration blows, specified in S7.2.2, starts at two minutes and is completed by four minutes, after removal of the helmet from the conditioning environment.] **(53 F.R. 11280—April 6, 1988. Effective: October 3, 1988)**

[S7.2.4] The height of the guided free fall is 118.1 inches, [(3 m),] as measured from the striker point to the impact point on the outer surface of the test helmet.

[S7.2.5] The contactable surface of the penetration test headform is constructed of a metal or metallic alloy having a Brinell hardness number no greater than 55, which will permit ready detection should contact by the striker occur. The surface is refinished if necessary before each penetration test blow to permit detection of contact by the striker.

[S7.2.6] The weight of the penetration striker is 6 pounds, 10 ounces [(3 kg)].

[S7.2.7] The point of the striker has an included angle of 60°, a cone height of 1.5 inches [(3.8 cm)], a tip radius of 0.019 inch (standard 0.5 millimeter radius) and a minimum hardness of 60 Rockwell, C-scale.

S7.2.8 The rigid mount for the penetration test headform is as described in [S7.1.11].

S7.3 Retention system test.

S7.3.1 The retention system test is conducted by applying a static tensile load to the retention assembly of a complete helmet, which is mounted, as described in [S6.3], on a stationary test headform as shown in Figure 4, and by measuring the movement of the adjustable portion of the retention system test device under tension.

S7.3.2 The retention system test device consists of both an adjustable loading mechanism by which a static tensile load is applied to the helmet retention assembly and a means for holding the test headform and helmet stationary. The retention assembly is fastened around two freely moving rollers, both of which have 0.5 inch [(1.3 cm)] diameter and a 3-inch [(7.6 cm)] center-to-center separation, and which are mounted on the adjustable portion of the tensile loading device (Figure 4). The helmet is fixed on the test headform as necessary to ensure that it does not move during the application of the test loads to the retention assembly.

S7.3.3 A 50-pound [(22.7 kg)] preliminary test load is applied to the retention assembly, normal to the basic plane of the test headform and symmetrical with respect to the center of the retention assembly for 30 seconds, and the maximum distance from the extremity of the adjustable portion of the retention system test device to the apex of the helmet is measured.

S7.3.4 An additional 250-pound [(113.4 kg)] test load is applied to the retention assembly, in the same manner and at the same location as described in S7.3.3, for 120 seconds, and the maximum distance from the extremity of the adjustable portion of the retention system test device to the apex of the helmet is measured.

38 F.R. 22390
August 20, 1973

Appendix

Table 1.

Weights for Impact Attenuation Test Drop Assembly

Test Headform Size	Weight[1] — 1 lb(kg)
Small	7.8 (3.5 kg)
Medium	11.0 (5.0 kg)
Large	13.4 (6.1 kg)

[1]Combined weight of instrumented test headform and supporting assembly for drop test.

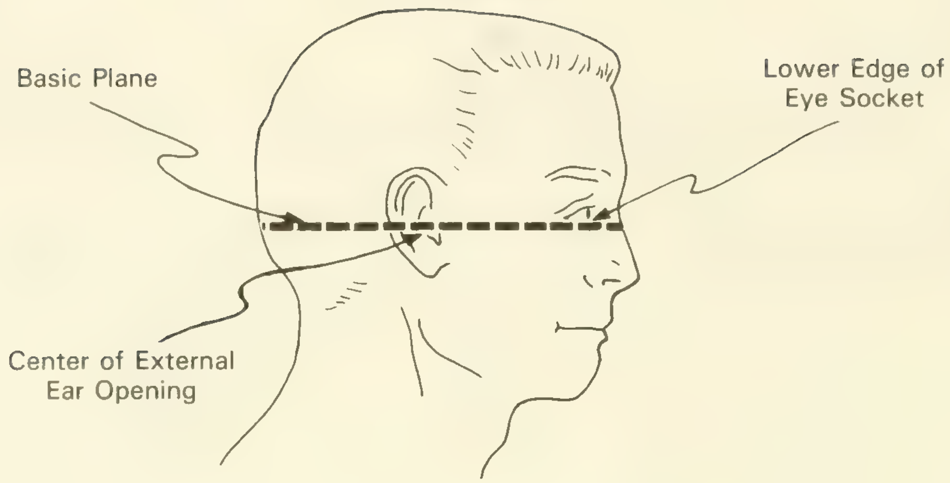


Figure 1.

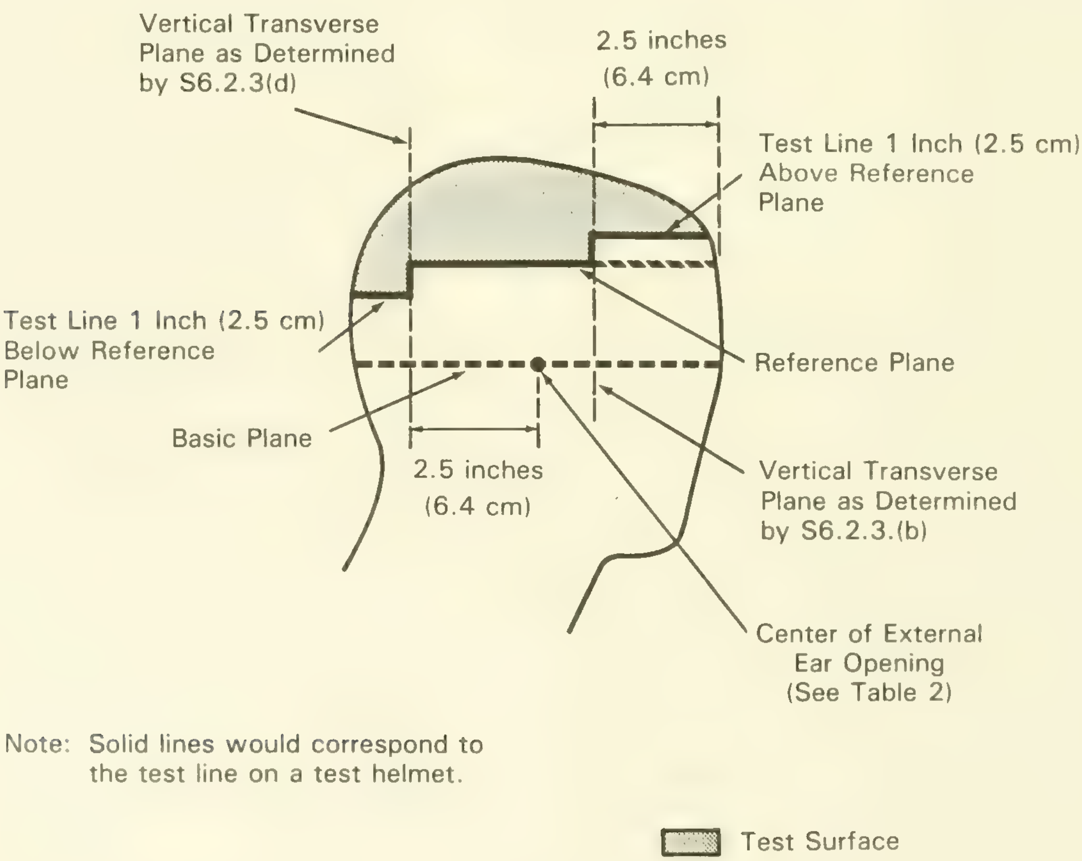


Figure 2.

Section Through the Basic Plane

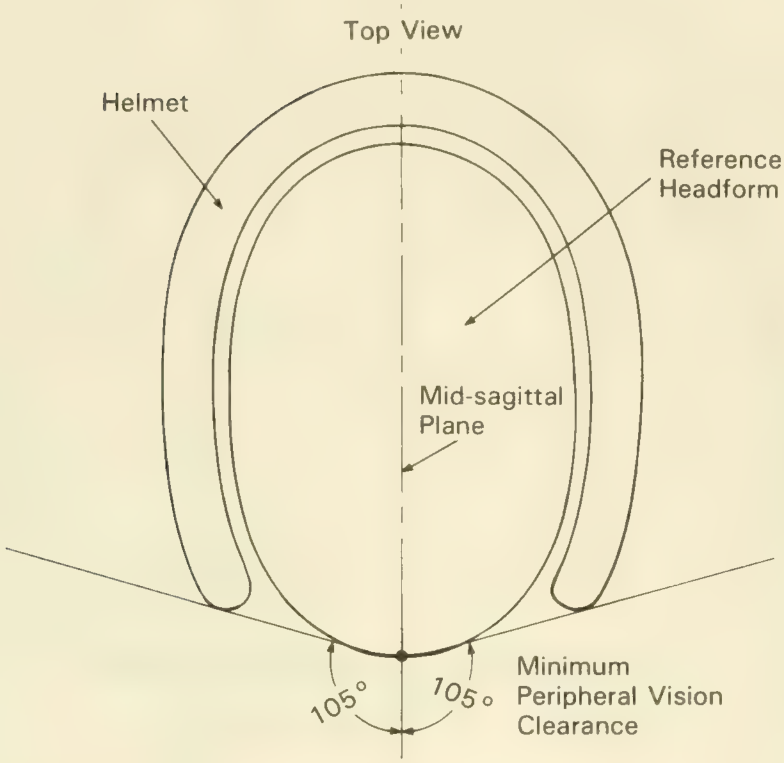
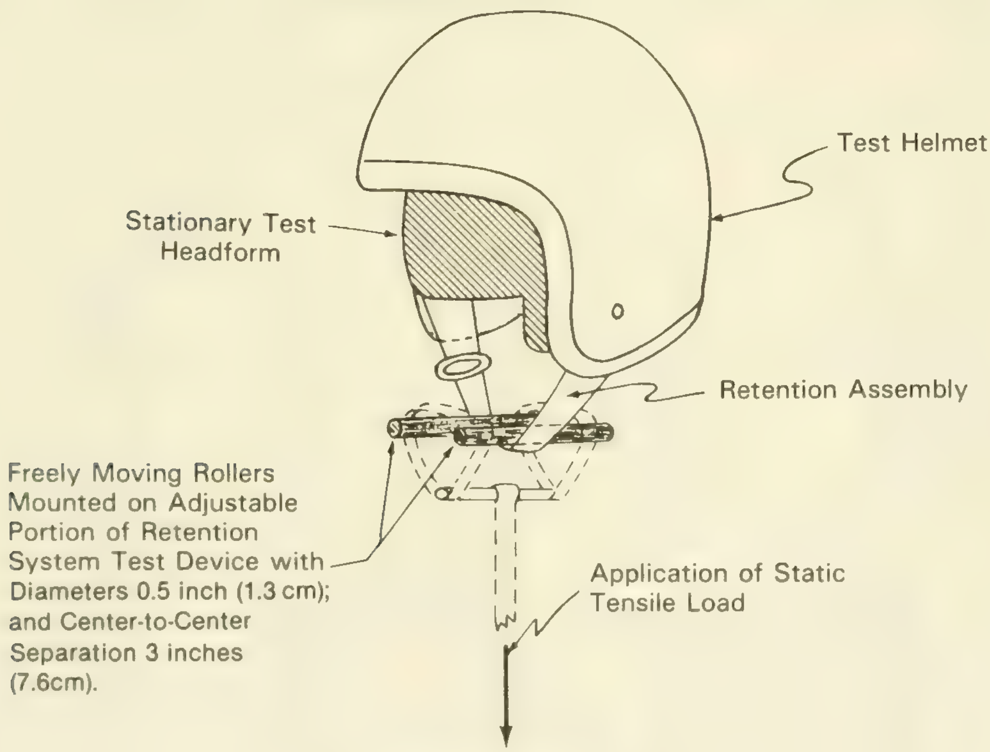


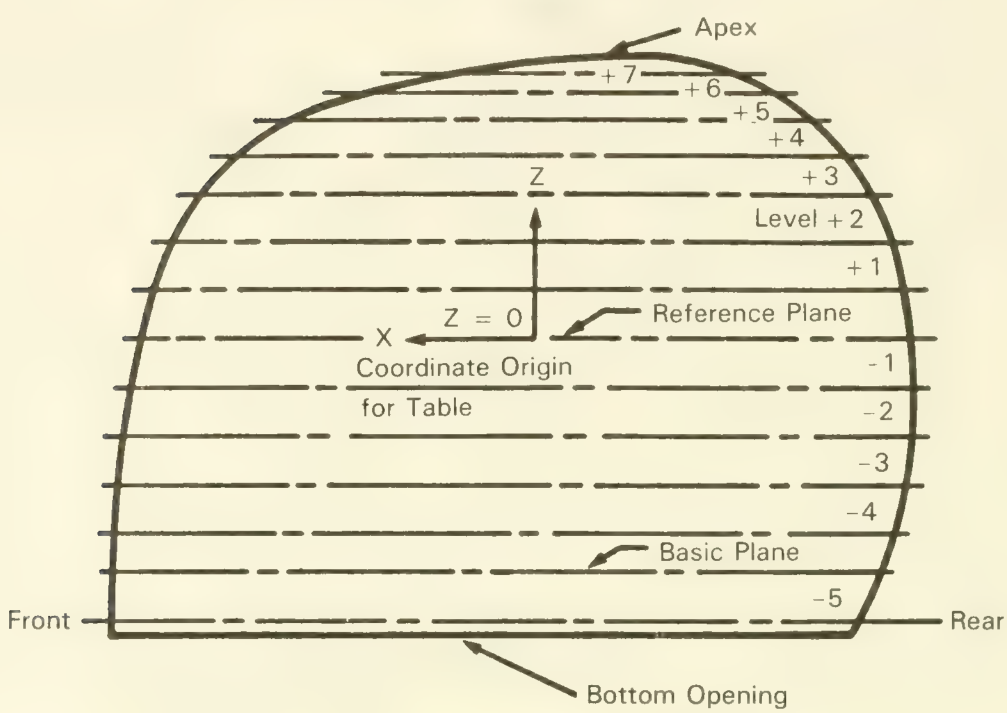
Figure 3.



Retention System Test Device

Figure 4.

Mid-Sagittal Plane (Symmetrical Plane)



Headform Coordinate Systems
(Right-hand Rule)

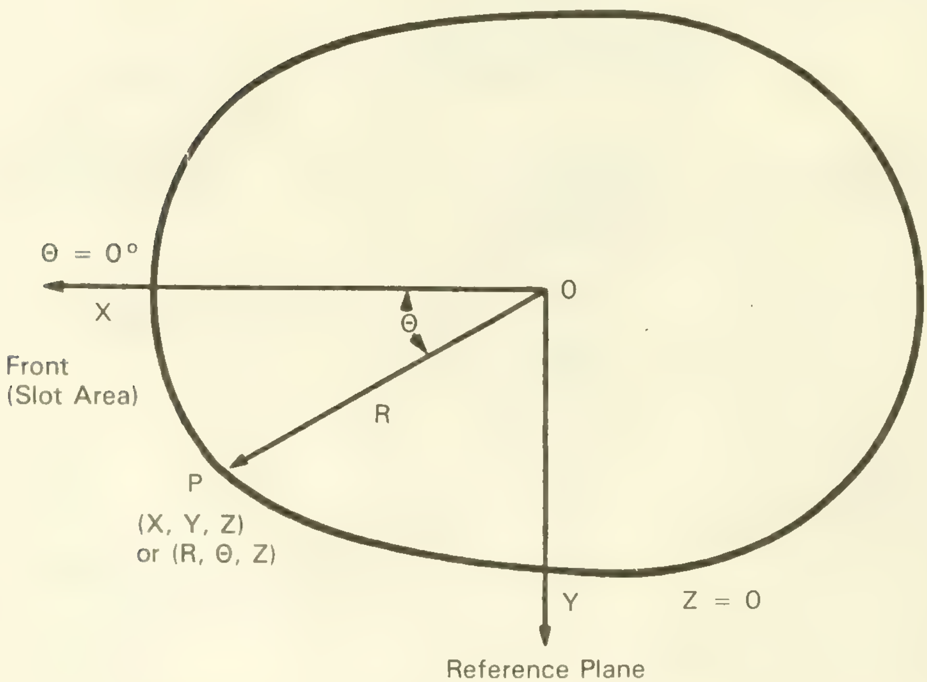


Figure 5. Headform Sections

Table 2

Medium Headform — Exterior Dimensions

Θ	Bottom Opening Z= –3.02			Level—5 Z= –2.900		
	R	X	Y	R	X	Y
0	4.292	4.292	0	4.293	4.293	0
10	4.266	4.201	0.741	4.270	4.205	0.742
20	4.159	3.908	1.423	4.172	3.920	1.427
30	3.967	3.436	1.984	3.961	3.430	1.981
40	3.660	2.804	2.353	3.670	2.811	2.359
50	3.332	2.142	2.553	3.352	2.155	2.568
60	3.039	1.520	2.632	3.067	1.534	2.656
70	2.839	0.971	2.668	2.869	0.981	2.696
80	2.720	0.472	2.679	2.772	0.481	2.730
90	2.675	0	2.675	2.709	0	2.709
100	2.703	–0.469	2.662	2.724	–0.473	2.683
110	2.764	–0.945	2.597	2.794	–0.956	2.626
120	2.888	–1.444	2.501	2.917	–1.459	2.526
130	2.985	–1.919	2.287	3.040	–1.954	2.329
140	3.100	–2.375	1.993	3.175	–2.432	2.041
150	3.175	–2.750	1.588	3.232	–2.799	1.616
160	3.186	–2.994	1.090	3.246	–3.050	1.110
170	3.177	–3.129	0.552	3.237	–3.188	0.562
180	3.187	–3.187	0	3.246	–3.246	0

Θ	Basic Plane Z= –2.360			Level—4 Z= –2.000		
	R	X	Y	R	X	Y
0	4.272	4.272	0	4.247	4.247	0
10	4.248	4.184	0.738	4.223	4.159	0.733
20	4.147	3.897	1.418	4.120	3.872	1.409
30	3.961	3.430	1.981	3.940	3.412	1.970
40	3.687	2.824	2.370	3.683	2.821	2.367
50	3.384	2.175	2.592	3.392	2.180	2.598
60	3.111	1.556	2.694	3.132	1.566	2.712
70	2.927	1.001	2.751	2.960	1.012	2.782
80	2.815	0.489	2.772	2.860	0.497	2.817
90	2.779	0	2.779	2.838	0	2.838
100	2.802	–0.487	2.759	2.861	–0.497	2.818
110	2.887	–0.987	2.713	2.958	–1.012	2.780
120	3.019	–1.510	2.615	3.098	–1.549	2.683
130	3.180	–2.044	2.436	3.260	–2.096	2.497
140	3.306	–2.533	2.125	3.405	–2.608	2.189
150	3.398	–2.943	1.699	3.516	–3.045	1.758
160	3.458	–3.250	1.183	3.585	–3.369	1.226
170	3.475	–3.422	0.603	3.612	–3.557	0.627
180	3.472	–3.472	0	3.609	–3.609	0

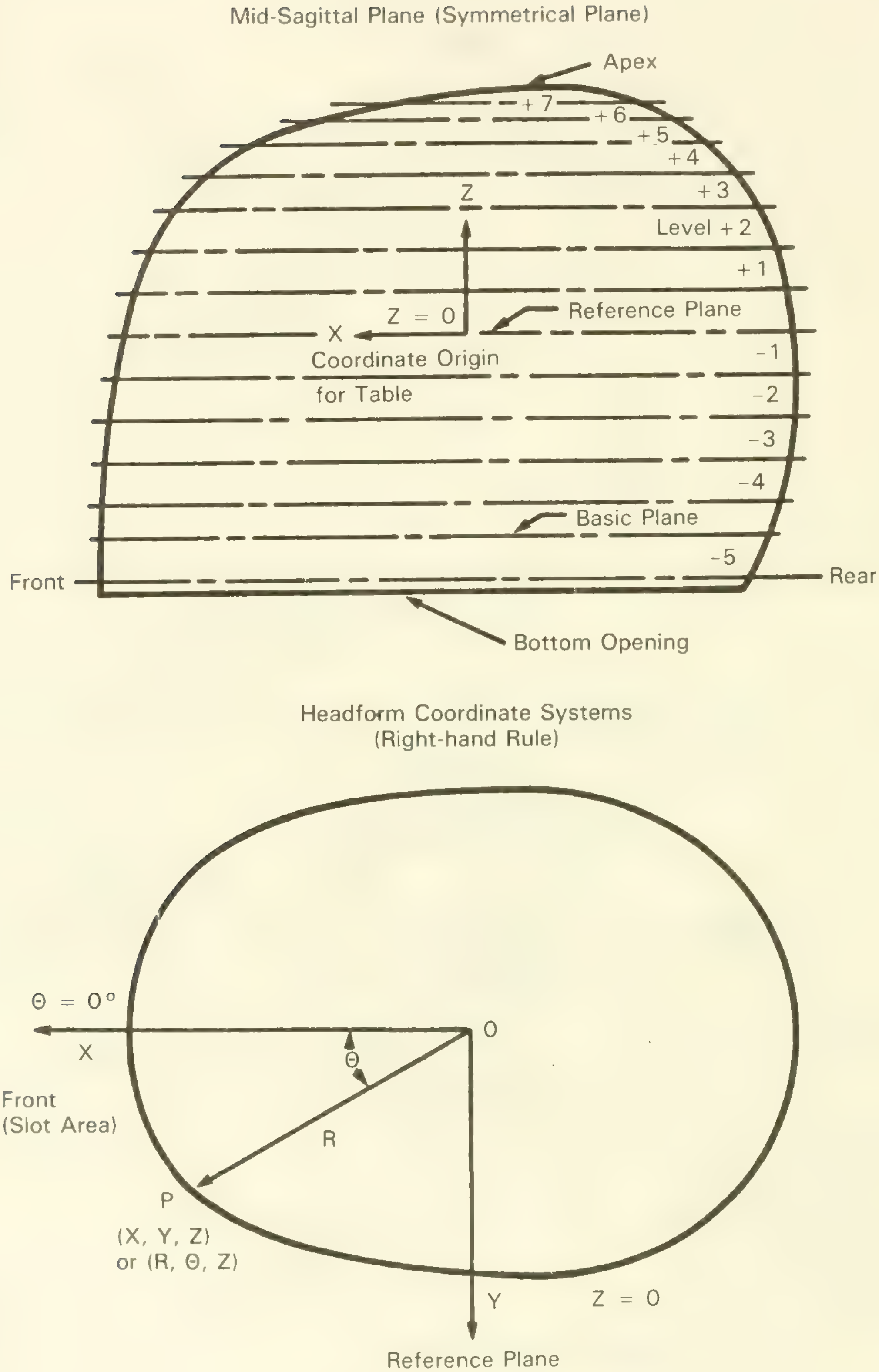


Figure 5. Headform Sections

Table 2

Medium Headform — Exterior Dimensions

Θ	Bottom Opening Z= −3.02			Level—5 Z= −2.900		
	R	X	Y	R	X	Y
0	4.292	4.292	0	4.293	4.293	0
10	4.266	4.201	0.741	4.270	4.205	0.742
20	4.159	3.908	1.423	4.172	3.920	1.427
30	3.967	3.436	1.984	3.961	3.430	1.981
40	3.660	2.804	2.353	3.670	2.811	2.359
50	3.332	2.142	2.553	3.352	2.155	2.568
60	3.039	1.520	2.632	3.067	1.534	2.656
70	2.839	0.971	2.668	2.869	0.981	2.696
80	2.720	0.472	2.679	2.772	0.481	2.730
90	2.675	0	2.675	2.709	0	2.709
100	2.703	−0.469	2.662	2.724	−0.473	2.683
110	2.764	−0.945	2.597	2.794	−0.956	2.626
120	2.888	−1.444	2.501	2.917	−1.459	2.526
130	2.985	−1.919	2.287	3.040	−1.954	2.329
140	3.100	−2.375	1.993	3.175	−2.432	2.041
150	3.175	−2.750	1.588	3.232	−2.799	1.616
160	3.186	−2.994	1.090	3.246	−3.050	1.110
170	3.177	−3.129	0.552	3.237	−3.188	0.562
180	3.187	−3.187	0	3.246	−3.246	0

Θ	Basic Plane Z= −2.360			Level—4 Z= −2.000		
	R	X	Y	R	X	Y
0	4.272	4.272	0	4.247	4.247	0
10	4.248	4.184	0.738	4.223	4.159	0.733
20	4.147	3.897	1.418	4.120	3.872	1.409
30	3.961	3.430	1.981	3.940	3.412	1.970
40	3.687	2.824	2.370	3.683	2.821	2.367
50	3.384	2.175	2.592	3.392	2.180	2.598
60	3.111	1.556	2.694	3.132	1.566	2.712
70	2.927	1.001	2.751	2.960	1.012	2.782
80	2.815	0.489	2.772	2.860	0.497	2.817
90	2.779	0	2.779	2.838	0	2.838
100	2.802	−0.487	2.759	2.861	−0.497	2.818
110	2.887	−0.987	2.713	2.958	−1.012	2.780
120	3.019	−1.510	2.615	3.098	−1.549	2.683
130	3.180	−2.044	2.436	3.260	−2.096	2.497
140	3.306	−2.533	2.125	3.405	−2.608	2.189
150	3.398	−2.943	1.699	3.516	−3.045	1.758
160	3.458	−3.250	1.183	3.585	−3.369	1.226
170	3.475	−3.422	0.603	3.612	−3.557	0.627
180	3.472	−3.472	0	3.609	−3.609	0

Table 2

Medium Headform — Exterior Dimensions (Continued)

Θ	Level—3 Z= −1.500			Level—2 Z= −1.000		
	R	X	Y	R	X	Y
0	4.208	4.208	0	4.148	4.148	0
10	4.179	4.116	0.726	4.112	4.050	0.714
20	4.075	3.829	1.394	4.013	3.771	1.373
30	3.902	3.379	1.951	3.844	3.329	1.922
40	3.654	2.799	2.349	3.609	2.765	2.320
50	3.377	2.171	2.587	3.352	2.155	2.568
60	3.094	1.547	2.680	3.137	1.569	2.717
70	2.982	1.020	2.802	2.989	1.022	2.809
80	2.891	0.502	2.847	2.902	0.504	2.858
90	2.876	0	2.876	2.884	0	2.884
100	2.918	−0.507	2.874	2.943	−0.511	2.898
110	3.021	−1.033	2.839	3.052	−1.044	2.868
120	3.170	−1.585	2.745	3.225	−1.613	2.793
130	3.337	−2.145	2.556	3.397	−2.184	2.602
140	3.483	−2.668	2.239	3.536	−2.709	2.273
150	3.604	−3.121	1.802	3.657	−3.167	1.829
160	3.682	−3.460	1.259	3.751	−3.525	1.283
170	3.725	−3.668	0.647	3.807	−3.749	0.661
180	3.741	−3.741	0	3.822	−3.822	0

Θ	Level—1 Z= −0.500			Reference Plane Z=0.0		
	R	X	Y	R	X	Y
0	4.067	4.067	0	3.971	3.971	0
10	4.033	3.972	0.700	3.935	3.875	0.683
20	3.944	3.706	1.349	3.853	3.621	1.318
30	3.777	3.271	1.889	3.701	3.205	1.851
40	3.552	2.721	2.283	3.491	2.674	2.244
50	3.323	2.136	2.546	3.279	2.108	2.512
60	3.126	1.563	2.707	3.101	1.551	2.686
70	2.987	1.022	2.807	2.979	1.019	2.799
80	2.912	0.506	2.868	2.910	0.505	2.866
90	2.893	0	2.893	2.890	0	2.890
100	2.895	−0.503	2.851	2.945	−0.511	2.900
110	3.064	−1.048	2.879	3.062	−1.047	2.877
120	3.231	−1.616	2.798	3.228	−1.614	2.796
130	3.411	−2.193	2.613	3.413	−2.194	2.615
140	3.560	−2.727	2.288	3.563	−2.729	2.290
150	3.682	−3.189	1.841	3.681	−3.188	1.841
160	3.783	−3.555	1.294	3.773	−3.546	1.290
170	3.885	−3.826	0.675	3.832	−3.774	0.665
180	3.857	−3.857	0	3.844	−3.844	0

Table 2

Medium Headform — Exterior Dimensions (Continued)

Θ	Level+1 Z=0.500			Level +2 Z=1.000		
	R	X	Y	R	X	Y
0	3.830	3.830	0	3.665	3.665	0
10	3.801	3.743	0.660	3.613	3.558	0.627
20	3.725	3.500	1.274	3.554	3.340	1.216
30	3.587	3.106	1.794	3.436	2.976	1.718
40	3.399	2.604	2.185	3.271	2.506	2.103
50	3.205	2.060	2.455	3.102	1.994	2.376
60	3.044	1.522	2.636	2.959	1.480	2.563
70	2.927	1.001	2.751	2.854	0.976	2.682
80	2.861	0.497	2.818	2.792	0.485	2.750
90	2.855	0	2.855	2.783	0	2.783
100	2.897	−0.503	2.853	2.832	−0.492	2.789
110	3.007	−1.029	2.826	2.938	−1.005	2.761
120	3.176	−1.588	2.751	3.102	−1.551	2.686
130	3.372	−2.168	2.583	3.294	−2.117	2.523
140	3.520	−2.697	2.263	3.450	−2.643	2.218
150	3.643	−3.155	1.822	3.564	−3.087	1.782
160	3.728	−3.503	1.275	3.637	−3.418	1.244
170	3.777	−3.720	0.656	3.675	−3.619	0.638
180	3.782	−3.782	0	3.670	−3.670	0

Θ	Level +3 Z=1.450			Level +4 Z=1.860		
	R	X	Y	R	X	Y
0	3.419	3.419	0	3.061	3.061	0
10	3.382	3.331	0.587	3.035	2.989	0.527
20	3.299	3.100	1.128	2.966	2.787	1.014
30	3.197	2.769	1.599	2.872	2.487	1.436
40	3.052	2.338	1.962	2.754	2.110	1.770
50	2.911	1.871	2.230	2.642	1.698	2.024
60	2.786	1.393	2.413	2.522	1.261	2.184
70	2.700	0.924	2.537	2.477	0.847	2.328
80	2.647	0.460	2.607	2.442	0.424	2.405
90	2.636	0	2.636	2.442	0	2.442
100	2.691	−0.467	2.650	2.492	−0.433	2.454
110	2.796	−0.956	2.627	2.599	−0.889	2.442
120	2.961	−1.481	2.564	2.758	−1.379	2.389
130	3.147	−2.023	2.411	2.936	−1.887	2.249
140	3.301	−2.529	2.122	3.081	−2.360	1.980
150	3.408	−2.951	1.704	3.176	−2.751	1.588
160	3.479	−3.269	1.190	3.230	−3.035	1.105
170	3.514	−3.461	0.610	3.270	−3.220	0.568
180	3.502	−3.502	0	3.271	−3.271	0

Table 2

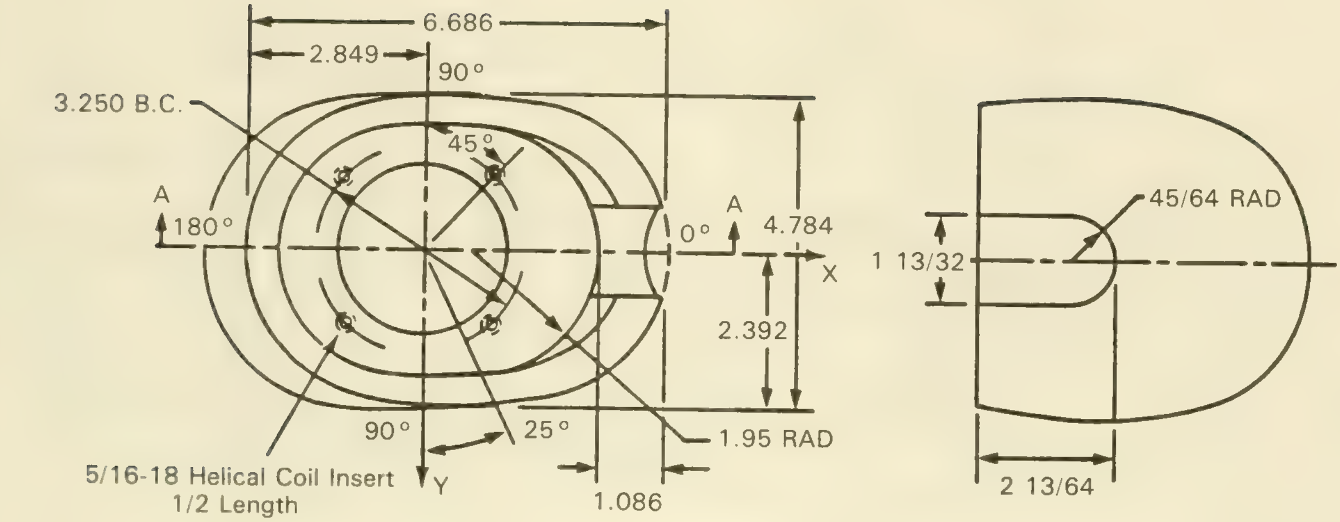
Medium Headform — Exterior Dimensions (Continued)

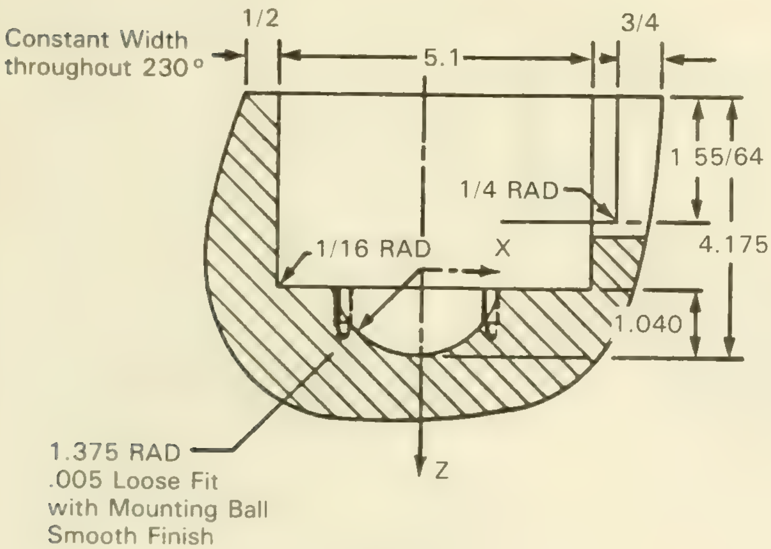
Θ	Level +5 Z=2.250			Level +6 Z=2.560		
	R	X	Y	R	X	Y
0	2.526	2.526	0	1.798	1.798	0
10	2.521	2.483	0.483	1.798	1.771	0.312
20	2.464	2.315	0.843	1.757	1.651	0.601
30	2.387	2.067	1.194	1.719	1.489	0.860
40	2.305	1.766	1.482	1.678	1.285	1.079
50	2.232	1.435	1.710	1.652	1.062	1.266
60	2.174	1.087	1.883	1.641	0.821	1.421
70	2.144	0.733	2.015	1.645	0.563	1.546
80	2.132	0.370	2.100	1.673	0.291	1.648
90	2.147	0	2.147	1.712	0	1.712
100	2.213	−0.384	2.179	1.809	−0.314	1.782
110	2.316	−0.792	2.176	1.925	−0.658	1.809
120	2.463	−1.232	2.133	2.066	−1.033	1.789
130	2.624	−1.687	2.010	2.213	−1.423	1.695
140	2.763	−2.117	1.776	2.358	−1.806	1.516
150	2.863	−2.479	1.432	2.469	−2.138	1.235
160	2.919	−2.743	0.988	2.536	−2.383	0.867
170	2.954	−2.909	0.513	2.561	−2.522	0.445
180	2.958	−2.958	0	2.556	−2.556	0

Θ	Level +7 Z=2.750		
	R	X	Y
0	1.081	1.081	0
10	1.088	1.072	0.189
20	1.055	0.991	0.361
30	1.039	0.900	0.520
40	1.039	0.796	0.668
50	1.052	0.676	0.806
60	1.068	0.534	0.925
70	1.106	0.378	1.039
80	1.171	0.203	1.153
90	1.242	0	1.242
100	1.422	−0.247	1.400
110	1.489	−0.509	1.399
120	1.683	−0.842	1.458
130	1.801	−1.158	1.380
140	1.954	−1.497	1.256
150	2.083	−1.804	1.042
160	2.138	−2.009	0.731
170	2.175	−2.142	0.378
180	2.175	−2.175	0

Notes:

1. Apex is located at (-0.75, 0, 3.02) for (X,Y,Z) or (0.75, 180, 3.02) for (R, Θ, Z).
2. Center of ear opening is located at (0.40, 2.78, -2.36) for (X,Y,Z) or (2.80, 81.8, -2.36) for (R,Θ,Z).
3. Scale all dimensions by 0.8941 for small headform.
4. Scale all dimensions by 1.069 for large headform.
5. Headform is symmetrical about the mid-sagittal plane.
6. Units:
   R,X,Y,Z — inches.
   Θ — degrees.
7. To obtain metric equivalents in centimeters, multiply each figure by 2.54.

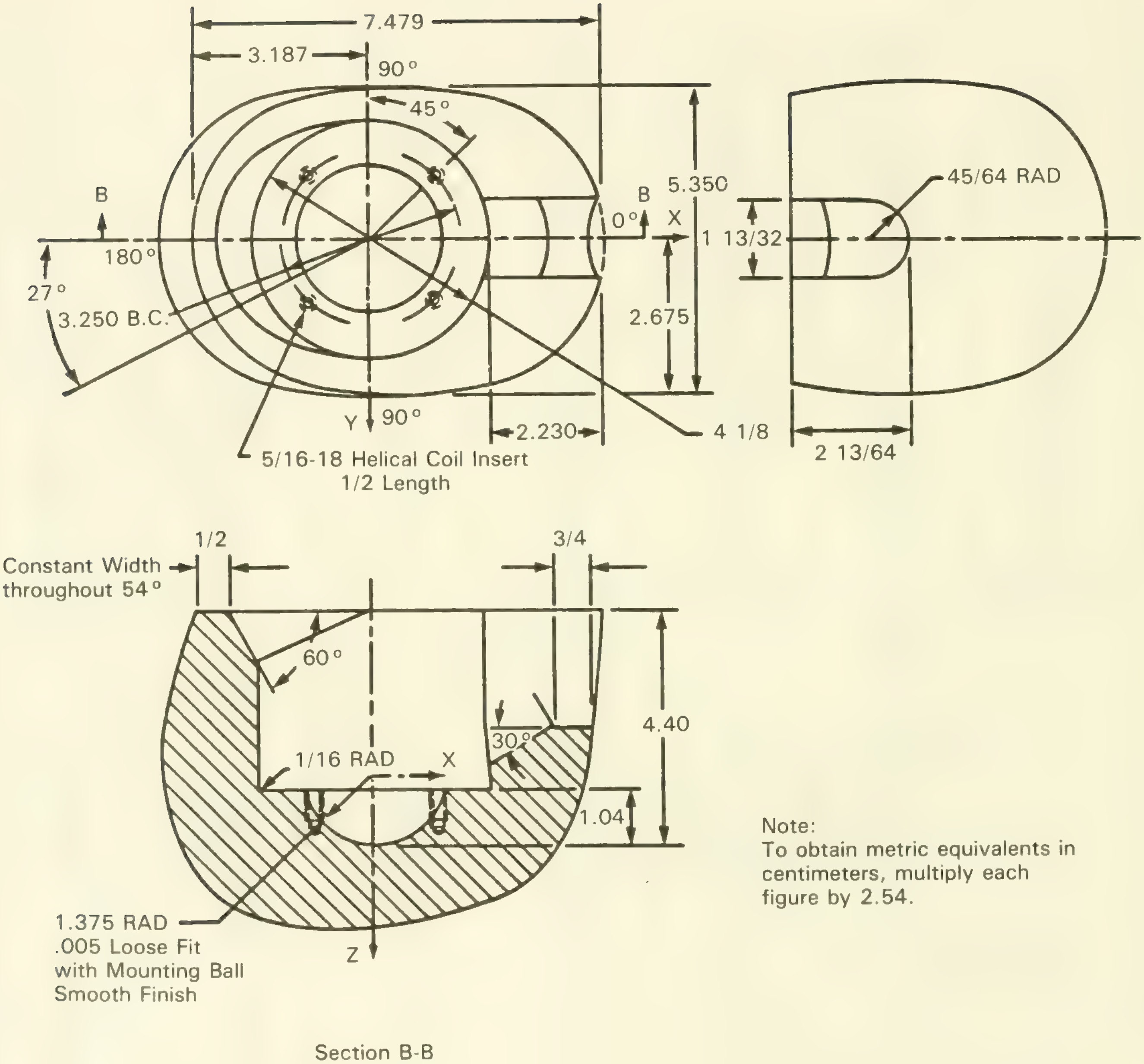




Section A-A

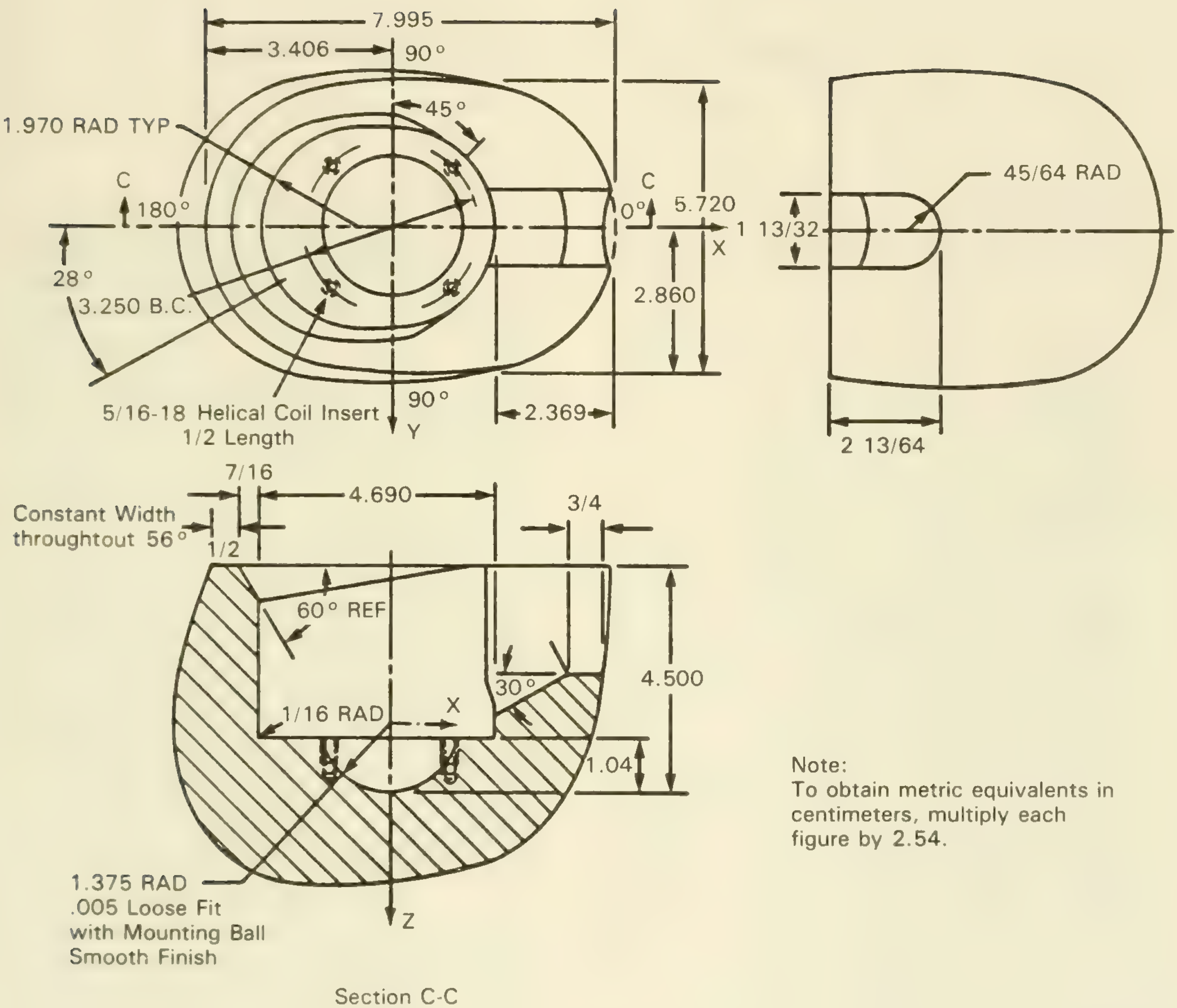
Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 6. Small Headform — Interior Design



Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 7. Medium Headform — Interior Design



Note:
To obtain metric equivalents in centimeters, multiply each figure by 2.54.

Figure 8. Large Headform — Interior Design

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 219

Windshield Zone Intrusion

(Docket No. 74–21; Notice 2)

This notice establishes a new Motor Vehicle Safety Standard No. 219, 49 CFR 571.219, that regulates the intrusion of vehicle parts from outside the occupant compartment into a defined zone in front of the windshield during a frontal barrier crash test.

The notice of proposed rulemaking on which this issuance is based was issued on May 20, 1974 (39 F.R. 17768). An earlier notice had been issued on August 31, 1972 (37 F.R. 17763), proposing a standard that would prohibit penetration of the protected zone by any part of a vehicle outside of the occupant compartment during a 30-mph frontal impact into a fixed barrier. After further study and an analysis of comments submitted in response to that notice, the NHTSA determined that the initial rule was unnecessarily stringent since its near-total ban on intrusion had the effect of prohibiting entrance into the protected zone or contact with the windshield by small particles such as paint chips and glass which do not represent a danger to the vehicle occupants if they enter the zone and impact the windshield opening with a limited amount of force.

Consequently, in the notice published on May 20, 1974, the proposed standard on windshield zone intrusion was amended to permit penetration by particles, to a depth of no more than one-quarter inch into a styrofoam template in the shape of the protected zone and affixed to the windshield, during a 30-mph frontal barrier crash.

In addition, the amended proposal published May 20, 1974, provided that contact by vehicle parts with the windshield opening in the area below the protected zone, during a 30-mph barrier crash test, would not be prohibited provided that the inner surface of that portion of the windshield is not penetrated. The procedure for determining the lower edge of the protected zone was also revised.

Standard No. 219, *Windshield Zone Intrusion*, reflects some minor changes incorporated for clarification following publication of the proposed rule on May 20, 1974. First, open-body-type vehicles with fold-down or removable windshields have been added to forward control vehicles as vehicle types to which the standard does not apply. A structurally unsupported windshield, essential to the utility of this vehicle type, typically does not remain in place during a 30-mph frontal barrier crash test, hence the test is impracticable for this type of vehicle.

In addition, the standard provides that its prohibitions against penetration by particles to a depth of more than one-quarter inch into the styrofoam template and penetration of the inner surface of the portion of the windshield below the protected zone do not apply to windshield molding and other components designed to be normally in contact with the windshield. This provision was contained in the proposed standard published August 31, 1972 but omitted from the proposal published May 20, 1974.

The standard as adopted also specifies that the 6.5-inch-diameter rigid sphere employed to determine the lower edge of the protected zone shall weigh 15 pounds, the approximate weight of the head and neck of an average driver or passenger.

Comments submitted by Wayne Corporation and Sheller-Globe Corporation, manufacturers of funeral coaches and ambulances, urged that the standard for windshield zone intrusion contain an exception for such vehicles in view of

the low incidence of accidents involving funeral coaches and ambulances, the low volume of production of such vehicles, and the high cost of barrier crash testing. The NHTSA has determined that these arguments are without merit. The manufacturers have presented no evidence to support the contention that funeral coaches and ambulances are involved in fewer accidents in proportion to their numbers than other vehicles. Furthermore, several comments criticizing the allegedly prohibitive costs of compliance with the standard appear to have erroneously assumed that every manufacturer must conduct barrier crash tests. The performance requirement for windshield zone intrusion is set out in S5. of the standard. A manufacturer of funeral coaches and ambulances may, for example, assure itself that the requirement is met by barrier crashing the conventional chassis which is a component of the special vehicle, modified to simulate the dynamic characteristics of the funeral coach or ambulance. Or, the manufacturer may use the design characteristic of the vehicle taking into account the modifications it makes, or information supplied by the chassis manufacturer.

Low volume of production is not an appropriate basis for an exemption. As the NHTSA has maintained in past proceedings where the same argument was advanced, the appropriate means to avoid application of a standard on hardship grounds is a temporary exemption under 49 CFR Part 555.

Finally, the NHTSA is continuing to promote compatibility and economy in barrier crash testing by adopting vehicle loading and dummy restraint requirements in Standard No. 219 identical to those set out in proposed amendments to Standard No. 301, *Fuel System Integrity*, 49 CFR 571.301 (40 F.R. 17036, April 16, 1975). It has therefore required that 50th-percentile test dummies be placed in the seating positions whose restraint system is required to be tested by a dummy under Standard No. 208, *Occupant Crash Protection*, 49 CFR 571.208, and that they may be restrained only by the means that are installed in the vehicle at the respective seating positions.

In consideration of the foregoing, 49 CFR Part 571 is amended by the addition of a new Standard No. 219, 49 CFR 571.219, *Windshield Zone Intrusion*. . . .

Effective date: September 1, 1976.

(Secs. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 C.F.R. 1.51.)

Issued on June 9, 1975.

James B. Gregory
Administrator

40 F.R. 25462
June 16, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 219

Windshield Zone Intrusion

(Docket No. 74–21; Notice 3)

This notice responds to four petitions for reconsideration of the notice published June 16, 1975 (40 FR 25462), which established a new Motor Vehicle Safety Standard No. 219, *Windshield Zone Intrusion*, 49 CFR 571.219, regulating the intrusion of vehicle parts from outside the occupant compartment into a defined zone in front of the windshield during a frontal barrier crash test. The National Highway Traffic Safety Administration (NHTSA) hereby amends Standard No. 219 on the basis of the information and arguments presented by some of the petitioners.

Petitions for reconsideration were received from the Motor Vehicle Manufacturers Association (MVMA), General Motors, Ford, and Jeep. MVMA, General Motors, and Ford requested substitution of the term "daylight opening" for "windshield opening," and General Motors and Jeep requested a change in the effective date of Standard No. 219 from September 1, 1976 to September 1, 1977. In addition, Jeep requested that Standard No. 219 not become applicable until final issuance of Standard No. 212, *Windshield Mounting*, 49 CFR 571.212.

The NHTSA has determined that the petitions of MVMA, General Motors, and Ford requesting substitution of the term "daylight opening" for "windshield opening" have merit, and they are therefore granted. These petitioners requested that the term "windshield opening" be replaced by the term "daylight opening", which is defined in paragraph 2.3.12 of section E, Ground Vehicle Practice, SAE Aerospace-Automotive Drawing Standards, September, 1963. The part of the windshield below the daylight opening is protected by the cowling and instrument panel. There is little likelihood that in a frontal crash any vehicle component will penetrate the cowling and instrument panel with sufficient force to pose a threat to the vehicle occupants. Therefore, the zone intrusion requirements of Standard No. 219 should only apply to the area of the windshield susceptible to actual penetration by vehicle components in a crash. Accordingly, the term "windshield opening" as it is used in Standard No. 219, is replaced by "daylight opening." The SAE definition of "daylight opening" has been slightly modified to reflect the particular characteristics of Standard No. 219.

The NHTSA has concluded that the petitions of General Motors and Jeep requesting a change in the effective date of Standard No. 219 should be granted in part and denied in part. The economic considerations involved in coordinating the effective date of Standard No. 219 with that of Standard No. 212, *Windshield Mounting*, justify postponement of the effective date to September 1, 1977, for application of Standard No. 219 to all vehicles except passenger cars. However, the effective date of September 1, 1976, will be retained for passenger cars because of their greater susceptibility to the intrusion of vehicle parts against which this standard is designed to protect. This postponement of effective dates also grants in part Jeep's petition requesting that the applicability of Standard No. 219 be postponed until final issuance of Standard No. 212.

In consideration of the foregoing, § 571.219 is amended by revising S4., S5., and S6.1(d) of Standard No. 219, *Windshield Zone Intrusion*, to read as follows:

Effective date: September 1, 1976, for passenger cars; September 1, 1977, for multipurpose

passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.51.)

Issued on November 10, 1975.

James B. Gregory
Administrator

40 F.R. 53033
November 14, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 219

Windshield Zone Intrusion

(Docket No. 74-21; Notice 5)

This notice amends Standard No. 219, *Windshield Zone Intrusion*, to exclude walk-in van-type vehicles from the requirements of the standard.

The National Highway Traffic Safety Administration (NHTSA) proposed to exclude walk-in van-type vehicles from the applicability of Standard No. 219 (49 CFR 571.219) in a notice published March 11, 1976 (41 FR 10451). No opposition was registered in response to the proposed rulemaking. The National Motor Vehicle Safety Advisory Council did not take a position on the proposal.

The NHTSA, therefore, amends Standard No. 219 in accordance with the proposal. For the information of all interested persons, the NHTSA considers a "walk-in van-type" vehicle to be only the "step van" city delivery type of vehicle that permits a person to enter the vehicle without stooping.

It has been determined that this amendment will have a negligible economic and environmental impact, since it creates an exemption from existing requirements that is expected to affect relatively few vehicles.

In consideration of the foregoing, paragraph S3 of Standard No. 219 (49 CFR 571.219) is amended . . . .

Effective date: December 16, 1976. Because this amendment relieves a restriction and does not create additional obligations for any person and because it permits the resumption of manufacture of a vehicle type not intended to be covered by the standard, it is found that an immediate effective date is in the public interest.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on December 10, 1976.

Charles E. Duke
Acting Administrator

41 FR 54945
December 16, 1976

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 219

Windshield Zone Intrusion

(Docket No. 79-14; Notice 2)

ACTION: Final Rule.

SUMMARY: This notice amends two safety standards, Standard No. 212, *Windshield Mounting,* and Standard No. 219, *Windshield Zone Intrusion,* to limit the maximum unloaded vehicle weight at which vehicles must be tested for compliance with these standards. This action is being taken in response to petitions from the Truck Body and Equipment Association and the National Truck Equipment Association asking the agency to amend the standards to provide relief from some of the test requirements for final-stage manufacturers. Many of these small manufacturers do not have the sophisticated test devices of major vehicle manufacturers. The agency concludes that the weights at which vehicles are tested can be lessened while providing an adequate level of safety for vehicles such as light trucks and while ensuring that compliance with these standards does not increase their aggressivity with respect to smaller vehicles.

EFFECTIVE DATE: Since this amendment relieves a restriction by easing the existing test procedure and will not impose any additional burdens upon any manufacturer, it is effective (upon publication).

FOR FURTHER INFORMATION CONTACT:

Mr. William Smith, Crashworthiness Division,
National Highway Traffic Safety Administration, 400 Seventh Street, S.W.,
Washington, D.C. 20590 (202-426-2242)

SUPPLEMENTARY INFORMATION:

On August 2, 1979, the National Highway Traffic Safety Administration published a notice of proposed rulemaking (44 FR 45426) relating to two safety standards: Standard Nos. 212, *Windshield Mounting,* and 219 *Windshield Zone Intrusion.* That notice proposed two options for amending the test procedures of the standards that were designed to ease the compliance burdens of small final-stage manufacturers.

The agency issued the proposal after learning that final-stage manufacturers were frequently unable to certify certain vehicles in compliance with these two safety standards. The problem arises because of weight and center of gravity restrictions imposed upon the final-stage manufacturer by the incomplete vehicle manufacturer. (The final-stage manufacturer typically purchases an incomplete vehicle from an incomplete vehicle manufacturer, usually Ford, General Motors or Chrysler.) The incomplete vehicle usually includes the windshield and mounting but does not include any body or work-performing equipment. Since the incomplete vehicle manufacturer installs the windshield, it represents to the final-stage manufacturer that the windshield will comply with the two subject safety standards. In making this representation, however, the incomplete vehicle manufacturer states that the representation is contingent on the final-stage manufacturer's adherence to certain restrictions. Any final-stage manufacturer that does not adhere to the restrictions imposed by the incomplete vehicle manufacturer must recertify the vehicle based upon its own information, analysis, or tests. The major restrictions imposed by the incomplete vehicle manufacturers on the final-stage manufacturer involve weight and center of gravity limitation. In many instances, these limitations have made it impossible for final-stage manufacturers either to rely on the incomplete vehicle manufacturer's certification or to complete vehicles on the same chassis that they were accustomed to using (prior to the extension of the two safety standards to these vehicle types). As a result, the final-stage manufacturer is faced either with buying

the same chassis as before and recertifying them or with buying more expensive chassis with higher GVWR's and less stringent weight and center of gravity limitations.

The agency has tried several different ways to alleviate this problem for the final-stage manufacturer. The NHTSA has met with representatives of the major incomplete vehicle manufacturers to encourage them to respond voluntarily by strengthening their windshield structures and reducing the restrictions that they currently impose upon final-stage manufacturers. The agency also discussed the possibility of its mandating these actions by upgrading Standards Nos. 212 and 219. Ford and General Motors indicated that the making of any major changes in these standards could lead to their deciding to discontinue offering chassis for use in the manufacturing of multi-stage vehicles. They said that such chassis were a very small percentage of their light truck sales and that, therefore, they would not consider it worth the cost to them to make any extensive modifications in their vehicles. NHTSA also asked the incomplete vehicle manufacturers to be sure that they have properly certified their existing vehicles and that they are not imposing unnecessarily restrictive limitations upon final-stage manufacturers. To this agency's knowledge, these vehicle manufacturers have neither undertaken any strengthening of their vehicles' windshield structures nor lessened any of their restrictions.

At the same time that the agency was made aware of the final-stage manufacturers' problems of certifying to these standards, the agency was becoming concerned about the possibility that compliance of some light trucks and vans with these standards might have made the vehicles more aggressive with respect to smaller passenger cars that they might impact. According to agency information, if these standards require a substantial strengthening of vehicle frames, the aggressivity of the vehicles is increased. Therefore, as a result of the agency's concern about aggressivity and its desire to address the certification problems of final-stage manufacturers in a manner that would not lead to a cessation of a chassis sales to those manufacturers, the agency issued the August 1979 proposal. The agency hoped that the proposal would allow and encourage incomplete vehicle manufacturers to reduce their weight and center of gravity restrictions, thereby easing or eliminating the compliance test burdens of final-stage manufacturers. The agency believed that this could occur using either option, because either would result in vehicles being tested at lower weights. Currently vehicles are tested under both standards at their unloaded vehicle weights plus 300 pounds.

The first option would have required some vehicles whose unloaded vehicle weights exceeded 4,000 pounds to be tested by being impacted with a 4,000 pound moving barrier. The second option proposed by the agency would have required vehicles to be tested at their unloaded vehicle weight up to a maximum unloaded vehicle weight of 5,500 pounds. This option was suggested to the agency by several manufacturers and manufacturer representatives.

Comments on Notice

In response to the agency's notice, nine manufacturers and manufacturer representatives submitted comments. All of the commenters supported some action in response to the problems of final-stage manufacturers. Most of the commenters also suggested that the agency's second alternative solution was more likely to achieve reductions in the restrictions being imposed by incomplete vehicle manufacturers. The first option would have created a new, unproven test procedure, and manufacturers would have been cautious in easing center of gravity or weight restrictions based upon this test procedure. Accordingly, most commenters were not sure that the first option would achieve the desired results. The consensus was, therefore, that the second option should be adopted.

Some manufacturers recommended that both options be permitted allowing the manufacturer to decide how to test its vehicles. The agency does not agree with this recommendation. Not only would it be more difficult and expensive to enforce a standard that has alternative test procedures, but most manufacturers prefer the 5,500 pound weight limit option. The NHTSA concludes that as a result of the comments supporting the 5,500 pound maximum test weight, that this is an acceptable procedure for testing compliance with these two standards. Therefore, the standards are amended to incorporate this procedure.

The major incomplete vehicle manufacturers commenting on the notice suggested that testing vehicles at a maximum weight of 5,500 pounds might provide some immediate relief. None of the major incomplete vehicle manufacturers provided any information concerning how substantial that relief might be. Ford indicated that any relief might be limited.

The agency believes that the incomplete vehicle manufacturers must accept the responsibility for establishing reasonable restrictions upon their incomplete vehicles. The NHTSA has not been provided with sufficient evidence substantiating the statements of the incomplete vehicle manufacturers that their existing restrictions are reasonable. In fact, some evidence indicates that unnecessarily stringent restrictions are being imposed because incomplete vehicle manufacturers do not want to conduct the necessary testing to establish the appropriate weight and center of gravity restrictions. Since this amendment should reduce the severity of the test procedures, the agency concludes that incomplete vehicle manufacturers should immediately review their certification test procedures and reduce the restrictions being passed on to final-stage manufacturers.

Due to changes in the light truck market, there is reason to believe that the incomplete vehicle manufacturers will be more cooperative than when the agency spoke to them before beginning this rulemaking. At that time, light truck sales were still running well. Now that these sales are down, these manufacturers may be more solicitous of the needs of the final-stage manufacturers. If relief is not provided by the incomplete vehicle manufacturers, then the agency will consider taking additional steps, including the upgrading of Standards Nos. 212 and 219 as they apply to all light trucks.

General Motors (GM) questioned one of the agency's rationales for issuing the notice of proposed rulemaking. GM stated that the agency concludes that this action will provide a more appropriate level of safety for the affected vehicles while the initial extension of these standards to the affected vehicles provides, in GM's view, only a slight increase in the level of safety of the vehicles. GM indicates that since the application of these standards to the affected vehicles provides only slight benefits and since this amendment will reduce those benefits, the standards should not apply to light trucks and vans. The agency disagrees with this suggestion.

The agency is currently reviewing the applicability of many of its safety standards to determine whether they ought to be extended to light trucks and other vehicles. Accident data clearly indicate the benefits that have resulted from the implementation of safety standards to cars. The fatality rate for passenger cars has decreased substantially since the implementation of a broad range of safety standards to those vehicles. On the other hand, light trucks and vans have not had a corresponding reduction in fatality rates over the years. The agency attributes much of this to the fact that many safety standards have not been applied to those vehicles. Since those vehicles are becoming increasingly popular as passenger vehicles, the agency concludes that safety standards must apply to them.

In response to GM's comment that this reduction in the test requirements for Standard Nos. 212 and 219 will remove all benefits derived by having the standards apply to those vehicles, the agency concludes that GM has misinterpreted the effects of this amendment. This amendment will reduce somewhat the compliance test requirements for those light trucks and vans with unloaded vehicle weights in excess of 5,500 pounds. It will not affect light trucks with unloaded vehicle weights below 5,500 pounds. According to agency information, approximately 25 percent of the light trucks have unloaded vehicle weights in excess of 5,500 while the remainder fall below that weight. As a result of weight reduction to improve fuel economy, it is likely that even more light trucks will fall below the 5,500 pound maximum test weight in the future. Therefore, this amendment will have no impact upon most light trucks and vans. In light of the small proportion of light trucks and vans affected by this amendment and considering the potential benefits of applying these standards to all light trucks and vans, the agency declines to adopt GM's suggestion that the standards be made inapplicable to these vehicles.

With respect to GM's question about the appropriate level of safety for light trucks, the agency's statement in the notice of proposed rulemaking was intended to show that the safety of light trucks and vans cannot be viewed without considering the relative safety of lighter vehicles

that they may impact. Accordingly, the level of safety that the agency seeks to achieve by this and other safety standards is determined by balancing the interests of the occupants of passenger cars and heavier vehicles.

GM also questioned the agency's statement that vehicle aggressivity may be increased by imposing too severe requirements on these vehicles. GM suggested that no evidence exists that vehicle aggressivity is increased as a result of complying with these standards.

The agency stated in the proposal that it was concerned that compliance with the standards as they now exist might have increased the aggressivity of the vehicles, thereby harming the occupants of passenger cars that are impacted by these larger, more rigid vehicles. The agency is now beginning to examine the full range of vehicle aggressivity problems. The docket for this notice contains a paper recently presented by a member of our staff to the Society of Automotive Engineers on this subject. The agency tentatively concludes, based upon the initial results of our research and analysis, that vehicle aggressivity could be a safety problem and that the agency considers that possibility in issuing its safety standards. The NHTSA notes that Volkswagen applauds the agency's recognition of the vehicle aggressivity factor in safety.

As to GM's argument that compliance with the standards may not have increased vehicle aggressivity, our information on this point came from the manufacturers. The manufacturers indicated that compliance with Standards 212 and 219 requires strengthening the vehicle frame. This makes a vehicle more rigid. Our analysis indicates that making a vehicle more rigid may also make it more aggressive. Therefore, the agency concludes partially on the basis of the manufacturer's information, that compliance with the safety standards as they are written may have increased the aggressivity of the vehicles.

Ford Motor Company suggested that, rather than change these two particular standards, the agency should amend the certification regulation (Part 568) to state that any vehicle that is barrier tested would be required only to comply to an unloaded vehicle weight of 5,500 pounds or less. Ford suggested that this would standardize all of the tests and provide uniformity.

The agency is unable to accept Ford's recommendation for several reasons. First, the certification regulation is an inappropriate place to put a test requirement applicable to several standards. The tests' requirements of the standards should be found in each standard. Second, the Ford recommendation would result in a reduction of the level of safety currently imposed by Standard No. 301, *Fuel System Integrity*.

As we stated earlier and in several other notices, the agency is legislatively forbidden to modify Standard No. 301 in a way that would reduce the level of safety now required by that standard. Even without this legislative mandate, the agency would not be likely to relieve the burdens imposed by Standard No. 301. That standard is extremely important for the prevention of fires during crashes. Compliance of a vehicle with this standard not only protects the occupants of the vehicle that is in compliance but also protects the occupants of vehicles that it impacts. The agency concludes that the standard now provides a satisfactory level of safety in vehicles, and NHTSA would not be likely to amend it to reduce these safety benefits even if such an amendment were possible.

With respect to fuel system integrity, several manufacturers suggested that the agency had underestimated the impact of that standard upon weight and center of gravity restrictions. These commenters indicated that compliance with that standard requires more than merely adding shielding to the fuel systems of the vehicles. The agency is aware that compliance with that standard in certain instances has imposed restrictions upon manufacturers. Nonetheless, the agency continues to believe that as a result of this amendment, the chassis manufacturers will be able to reduce their weight and center of gravity restrictions while still maintaining the compliance of their vehicles with Standard No. 301.

Chrysler commented that the agency should consider including the new test procedure in Standard No. 204 and all other standards that require barrier testing. The agency has issued a notice on Standard No. 204 (44 FR 68470) stating that it was considering a similar test provision for that standard. The agency also is aware that any barrier test requirement imposed upon vehicles subject to substantial modifications by final-stage

manufacturers will create problems for the final-stage manufacturers. Accordingly, the agency will consider the special problems of these manufacturers prior to the the issuance of standards that might affect them and will attempt to make the test requirements of the various standards consistent wherever possible.

The agency has reviewed this amendment in accordance with Executive Order 12044 and concludes that it will have no significant economic or other impact. Since the regulation relieves some testing requirements, it may slightly reduce costs associated with some vehicles. Accordingly, the agency concludes that this is not a significant amendment and a regulatory analysis is not required.

In accordance with the foregoing, Volume 49 of the Code of Federal Regulations Part 571 is amended by adding the following sentence to the end of paragraph S6.1(b) of Standard No. 212 (49 CFR 571.212) and paragraph S7.7(b) of Standard No. 219 (49 CFR 571.219).

Vehicles are tested to a maximum unloaded vehicle weight of 5,500 pounds.

The authors of this notice are William Smith of the Crashworthiness Division and Roger Tilton of the Office of Chief Counsel.

Issued on March 28, 1980.

Joan Claybrook
Administrator

45 F.R. 22044
April 3, 1980

MOTOR VEHICLE SAFETY STANDARD NO. 219

Windshield Zone Intrusion

S1. Scope. This standard specifies limits for the displacement into the windshield area of motor vehicle components during a crash.

S2. Purpose. The purpose of this standard is to reduce crash injuries and fatalities that result from occupants contacting vehicle components displaced near or through the windshield.

S3. Application. This standard applies to passenger cars and to multipurpose passenger vehicles, trucks and buses of 10,000 pounds or less gross vehicle weight rating. However, it does not apply to forward control vehicles, walk-in van-type vehicles, or to open body-type vehicles with fold-down or removable windshields.

S4. Definitions.

"Daylight Opening" (DLO) means the maximum unobstructed opening through the glazing surface, including reveal or garnish moldings adjoining the surface, as measured parallel to the outer surface of the glazing material.

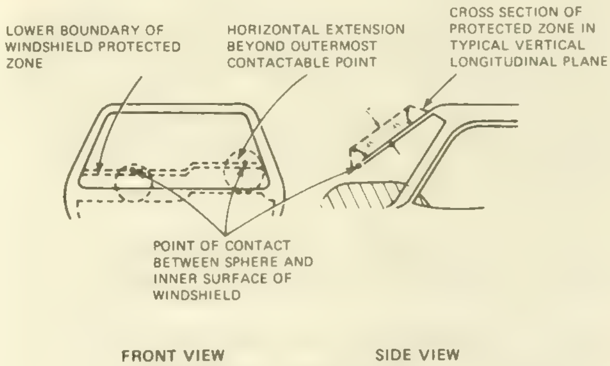
"Windshield opening" means the outer surface of the windshield glazing material.

S5. Requirement. When the vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, under the conditions of S7, no part of the vehicle outside the occupant compartment, except windshield molding and other components designed to be normally in contact with the windshield, shall penetrate the protected zone template, affixed according to S6, to a depth of more than one-quarter inch, and no such part of a vehicle shall penetrate the inner surface of that portion of the windshield, within the DLO, below the protected zone defined in S6.

S6. Protected zone template.

S6.1 The lower edge of the protected zone is determined by the following procedure (see Figure 1).

(a) Place a 6.5-inch diameter rigid sphere, weighing 15 pounds, in a position such that it simultaneously contacts the inner surface of the windshield glazing and the surface of the instrument panel, including padding. If any accessories or equipment such as the steering control system obstruct positioning of the sphere, remove them for the purposes of this procedure.



WINDSHIELD PROTECTED ZONE
Figure 1

(b) Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend

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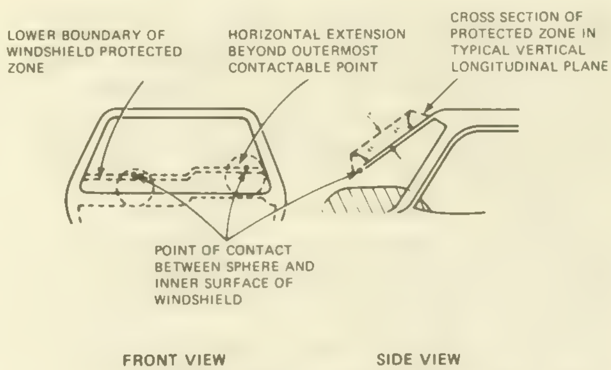


WINDSHIELD PROTECTED ZONE
Figure 1

windshield glazing and the surface of the instrument panel, including padding. If any accessories or equipment such as the steering control system obstruct positioning of the sphere, remove them for the purposes of this procedure.

(b) Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend

the locus line horizontally to the edges of the glazing material.

(c) Draw a line on the inner surface of the windshield below and one-half inch distant from the locus line.

(d) The lower edge of the protected zone is the longitudinal projection onto the outer surface of the windshield of the line determined in S6.1(c).

S6.2 The protected zone is the space enclosed by the following surfaces, as shown in Figure 1:

(a) The outer surface of the windshield in its precrash configuration.

(b) The locus of points 3 inches outward along perpendiculars drawn to each point on the outer surface of the windshield.

(c) The locus of lines forming a 45° angle with the outer surface of the windshield at each point along the top and side edges of the outer surface of the windshield and the lower edge of the protected zone determined in S6.1, in the plane perpendicular to the edge at that point.

S6.3 A template is cut or formed from Styrofoam, type DB, cut cell, to the dimensions of the zone as determined in S6.2. The template is affixed to the windshield so that it delineates the protected zone and remains affixed throughout the crash test.

S7. Test conditions. The requirement of S5 shall be met under the following conditions:

S7.1 The protected zone template is affixed to the windshield in the manner described in S6.

S7.2 The hood, hood latches, and any other hood retention components are engaged prior to the barrier crash.

S7.3 Adjustable cowl tops or other adjustable panels in front of the windshield are in the position used under normal operating conditions when windshield wiping systems are not in use.

S7.4 The parking brake is disengaged and the transmission is in neutral.

S7.5 Tires are inflated to the vehicle manufacturer's specifications.

S7.6 The fuel tank is filled to any level from 90 to 95 percent of capacity.

S7.7 The vehicle, including test devices and instrumentation, is loaded as follows:

(a) Except as specified in S7.6, a passenger car is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus a 50th-percentile test dummy as specified in Part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208. Each dummy is restrained only by means that are installed for protection at its seating position.

(b) Except as specified in S7.6, a multipurpose passenger vehicle, truck or bus is loaded to its unloaded vehicle weight, plus 300 pounds or its rated cargo and luggage capacity, whichever is less, secured to the vehicle, plus a 50th-percentile test dummy as specified in Part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208. Each dummy is restrained only by means that are installed for protection at its seating position. The load is distributed so that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR. If the weight on any axle when the vehicle is loaded to its unloaded vehicle weight plus dummy weight exceeds the axle's proportional share of the test weight, the remaining weight is placed so that the weight on that axle remains the same. For the purposes of this section, unloaded vehicle weight does not include the weight of work-performing accessories.

40 F.R. 25462
June 16, 1975

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 220

School Bus Rollover Protection

(Docket No. 75–2; Notice 2)

This notice establishes a new motor vehicle safety Standard No. 220, *School Bus Rollover Protection*, 49 CFR 571.220, specifying performance requirements for the structural integrity of the passenger compartment of school buses when subjected to forces that can be encountered in rollovers.

The Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Act) mandate the issuance of Federal motor vehicle safety standards for several aspects of school bus performance, including crashworthiness of the vehicle body and frame. Pub. L. 93–942, section 202 (15 U.S.C. 1392(i)(1)(A)). Based on this mandate and on bus body crashworthiness research (DOT–HS–046–3–694), the NHTSA proposed rollover protection requirements for school buses (40 F.R. 8570, February 28, 1975). Citing statistics on the safety record of school bus operation, several manufacturers questioned whether any standard for school bus rollover protection could be justified.

The Act reflects a need, evidenced in correspondence to the NHTSA from the public, to protect the children who ride in school buses. They and their parents have little direct control over the types of vehicles in which they ride to school, and are not in a position to determine the safety of the vehicles. It is for this reason that the school bus standards must be effective and meaningful.

At the same time, the safety history of school buses does not demonstrate that radical modification of school bus structure would substantially decrease occupant death and injury. As noted in the "School Bus Safety Improvement Program" contract conducted by Ultrasystems, Inc., (DOT–HS–046–3–694) for the NHTSA:

"School buses are a relatively safe mode of human transportation. School bus accident rates and injury/fatality rates on a per-vehicle, per-vehicle-mile, per-passenger-mile, or per-passenger basis are significantly less than for other passenger vehicles. Accidents to school children while enroute to and from school occur primarily in modes other than as school bus passengers. However, school bus safety can and should be improved."

As a practical matter, the amount of structural modification called for in this standard is also limited as a result of the 9-month lead time available to implement the provisions of each school bus standard after its promulgation. The various new requirements imposed in response to the mandate of the Act will require considerable effort by school bus manufacturers to bring their products into conformity in the 9-month period.

The Physicians for Automotive Safety, The National Transportation Safety Board, the Home Insurance Company and other commenters suggested that the NHTSA had ignored the recommendations of the report submitted by Ultrasystems on school bus improvement. The report concluded that the improved school bus design tested by Ultrasystems could withstand a significantly greater load for the same amount of roof crush than existing school bus designs.

In fact, the NHTSA evaluated the test results and Ultrasystem's recommendations carefully. While the percentage of reduction of roof crush would be substantial as a result of the recommended design change, no relationship of this decrease in deflection to improved safety for occupants was established. Ultrasystems reported that increases of $500 in cost and 530 pounds were incurred to achieve several improve-

ments, including those of the vertical roof crush test.

The recommendations also implied increased structural rigidity but did not evaluate its effect on the amount of energy absorbed by vehicle occupants in a crash. Also, Ultrasystems, did not consider the problems of lead time and retooling costs in making its recommendations. The NHTSA continues to consider that its proposal of $5\frac{1}{8}$ inches of maximum roof crush under a load equal to $1\frac{1}{2}$ times the vehicle's unloaded weight provides a satisfactory level of occupant crash protection. Available data do not support the conclusion that a 2- or 3-inch reduction of this crush would significantly improve the level of passenger safety in school buses. It is the intention of the NHTSA to continually review accident statistics relating to school bus safety. Accordingly, future upgrading of the standard will be considered should such action be warranted based upon availability of appropriate data.

In response to inquiries from the Motor Vehicle Manufacturers Association and General Motors as to the origin of the $5\frac{1}{8}$-inch requirement, the limit is drawn from the existing School Bus Manufacturers Institute requirement for school bus structural integrity (Static Load Test Code for School Bus Body Structure, issued by the School Bus Manufacturers Institute).

In adopting the $5\frac{1}{8}$-inch limit found in the present industry standard, the NHTSA is not merely preserving the status quo. While a manufacturer may have designed its products to meet the industry standard in the past, certain of its products presumably performed either better or worse than the nominal design. Conformity to NHTSA standards, in contrast, requires that every vehicle be capable of meeting the $5\frac{1}{8}$-inch limit. This means that the manufacturer must design its vehicles to meet a higher level of performance, to provide a compliance margin for those of its products which fall below the nominal design level. Of course, the manufacturer can reduce the compliance-margin problem without redesign by improving the consistency of its manufacturing processes.

The standard requires that, upon the application of vertical downward force to the bus roof equal to $1\frac{1}{2}$ times the vehicle's unloaded weight, the vehicle roof shall not crush more than $5\frac{1}{8}$ inches, and the emergency exits shall be capable of being opened, with the weight applied, and after its release. The National Transportation Safety Board, the Vehicle Equipment Safety Commission (VESC), Mercedes-Benz, and the Action for Child Transportation Safety organization suggested other methods for evaluation of crashworthiness. The NHTSA has considered these, but concludes that the static test specified in this standard provides a reasonable means to determine crashworthiness without unnecessary testing expense.

Based on submitted comments, the standard varies in some respects from the proposal. The sizes of the force application plates used to apply force and the method of application have been revised to simplify the test procedures and equipment, and to spread the force over larger areas of the vehicle roofs of large and small vehicles. The proposal specified a rigid, rectangular force application plate 36 inches wide and 20 inches shorter than the vehicle roof, preventing reliance on the roof end structures for rollover protection in typical body-on-chassis construction. Commenters pointed out that the end structures of the roof are almost certain to bear the weight of a rollover and should be included in a test of a vehicle's crashworthiness. Several manufacturers and other commenters recommended an increase in the size of the force application plate, in order to permit the foremost and rearmost roof "bows" of their buses to absorb a portion of the test load. Ford Motor Company stated it had performed the test as proposed and asserted that the roof of its van-type vehicle, as presently designed could not meet the requirement without an increase in the size of the force application plate to distribute the load over the entire vehicle roof. Chrysler Corporation stated it would find it necessary to discontinue production of small school buses because of redesign costs if the requirements were adopted as proposed.

With a view to the safety record of school buses and the 9-month lead time, the NHTSA concludes that the force application plate can be modified so that an additional "bow" or "bows" bear part of the applied force. It is the NHTSA's view that a change to permit both

roof end structures to fully contribute to support of the applied force in the case of buses of more than 10,000 pounds would be a relaxation of current industry practices. Accordingly, the extent of change recommended by the industry is not adopted. The NHTSA concludes that an 8-inch increase in the length of the force application plate is sufficient to allow some portion of the applied force to be absorbed by the end bows of the roof while maintaining adequate crash protection. Therefore, for these buses the width of the plate remains as proposed while the length of the plate is increased 8 inches.

In the case of lighter buses, which are generally of the van type, the NHTSA has increased both the width and length of the plate to encompass the entire roof.

The procedure for applying force through the plate has also been modified in some respects. Many comments objected that the procedure required an expensive, complex hydraulic mechanism that would increase the costs of compliance without justification. The proposal specified an "evenly-distributed vertical force in a downward direction through the force application plate", starting with the plate horizontal. Commenters interpreted these specifications to mean that the vehicle would be required to absorb the energy in evenly-distributed fashion and that the horizontal attitude of the plate must be maintained.

Actually these specifications were included in the proposed method to advise manufacturers of the precise procedures to be employed in compliance testing of their products. Understanding that some manufacturers may choose to achieve the required force application by applying weights evenly over the surface of the plate, the standard specified an "evenly-distributed force" to eliminate other methods (such as a concentrated force at one end of the plate) that could unfairly test the vehicle structure. The horizontal attitude of the plate was also intended to establish a beginning point for testing on which a manufacturer can rely. While these specifications establish the exact circumstances under which vehicles can be tested, a manufacturer can depart from them as long as it can be shown that the vehicle would comply if tested exactly as specified. In place of the perfectly rigid plate called for in the standard, for example, a manufacturer could employ a plate of sufficient stiffness to ensure that the test results are not affected by the lack of rigidity.

Some modification of the test procedures has been made for simplification and clarity. To permit placement of the plate on the roof to begin testing without a suspension mechanism, the specification for horizontal attitude is modified to permit the plate to depart from the horizontal in the fore and aft direction only. Some manufacturers considered the initial application of force as an unnecessary complication. However, the initial force application of 500 pounds has been retained in order to permit elimination of inconsequential deformation of the roof structure prior to measurement of the permissible 5⅛ inches of deflection. In instances where the force application plate weighs more than 500 pounds, some type of suspension mechanism could be used temporarily to constrain the load level to the initial value, if the manufacturer decides to conduct his testing exactly as specified in the standard's procedures.

The requirement that force be applied "through the plate" has been changed to "to the plate" in order to avoid a misunderstanding that the vehicle must absorb energy evenly over the surface of its roof.

As proposed by several commenters, the rate of application in pounds per minute has been changed to inches per second, specifically "at any rate not more than ½ inch per second." Manufacturers should understand that "any" in this context is defined by the NHTSA (49 CFR § 571.4) to mean that the vehicle roof must satisfy the requirement at every rate of application within the stated range. General Motors reports that as a practical matter, the effect of speed in rate of application for tests of this nature is not significant in the range of 0.12 inches per second to 1 inch per second.

The requirement that movement "at any point" on the plate not exceed 5⅛ inches has not been modified despite some objections. The NHTSA considers it reasonable that excessive crush not be permitted at the extremities of the plate. Measurement of movement only at the center of the plate, for example, would permit total collapse of the structure in any direction as long as one point on the bus maintained its integrity.

The preparation of the vehicle for the application of force has been modified to specify replacement of non-rigid body mounts with equivalent rigid mounts. The compression of deformable body mounts is unrelated to crashworthiness of the structure and can therefore be eliminated to permit testing of the structure itself.

Accessories or components which extend upward from the vehicle's roof (such as school bus lights) are removed for test purposes. It is also noted that the vehicle's transverse frame members or body sills are supported for test purposes. In response to a question from Blue Bird Body Company, a frame simulator may be used along with any other variations as long as the manufacturer assures himself that the vehicle would conform if tested precisely as specified in the standard.

The vehicle's emergency exits must also be capable of opening when the required force is applied, and following release of the force. As noted in comments, this requirement simulates the use of the exits after a rollover, whether or not the vehicle comes to rest on its roof. The proposed requirement of ability to close these exits is eliminated because such a capability is unnecessary in an emergency evacuation of the bus. For this reason, the requirement has been modified so that a particular test specimen (*i.e.*, a particular bus) will not be required to meet requirements for emergency exits which open following release of force, if the exits have already been tested while the application force is maintained.

With regard to the requirements as a whole, Crown Coach and other manufacturers argued that the application of 1½ times the vehicle's unloaded weight unfairly discriminates against buses with a higher vehicle weight-to-passenger ratio. The NHTSA disagrees, and notes that the relevant consideration in rollover is the weight of the vehicle itself in determining the energy to be absorbed by the structure. In a related area, one manufacturer suggested that the increased weight of the NHTSA's contemplated new standards for school buses would increase unloaded vehicle weight to the point where redesign would be required to meet the rollover standard. The NHTSA has considered this issue and estimates that the only significant new weight would be for improved seating. This weight increase would not substantially increase the severity of the rollover standard.

The State of California suggested consolidation of the rollover standard with the joint strength. While such a consolidation would appear logical for school buses alone, the NHTSA prefers the flexibility of separate standards with a view to their use independently in the future for other vehicle types. For example, the application of vertical force to the vehicle structure may be appropriate in a vehicle for which the joint strength requirement would not be appropriate.

The State of Georgia requested that transit systems transporting school children be exempted from Standard No. 220. This commenter apparently misunderstood the applicability of the standard. It only applies to newly-manufactured vehicles and does not require modification of existing fleets, whether or not operated by a transit authority.

Interested persons should note that the NHTSA has issued a proposal to modify the definition of "school bus" (40 F.R. 40854, September 1, 1975) and that if that definition is adopted the requirements of this standard will apply to all vehicles that fall within the definition, whether or not they fall within the present definition.

In consideration of the foregoing, a new motor vehicle safety standard No. 220, *School Bus Rollover Protection*, is added as § 571.220 of Part 571 of Title 49, Code of Federal Regulations. . . .

Effective date: October 26, 1976.

The effective date of this standard is established as 9 months after the date of its issuance, as required by the Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492, section 202 (15 U.S.C. 1397(i)(1)(A)).

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); § 202, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.51)

Issued on January 22, 1976.

Howard J. Dugoff
Acting Administrator

41 F.R. 3874
January 27, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 220

School Bus Rollover Protection

(Docket No. 73–3; Notice 7)
(Docket No. 73–20; Notice 10)
(Docket No. 73–34; Notice 4)
(Docket No. 75–2; Notice 3)
(Docket No. 75–3; Notice 5)
(Docket No. 75–7; Notice 3)
(Docket No. 75–24; Notice 3)

This notice announces that the effective dates of the redefinition of "school bus" and of six Federal motor vehicle safety standards as they apply to school buses are changed to April 1, 1977, from the previously established effective dates. This notice also makes a minor amendment to Standard No. 220, *School Bus Rollover Protection*, and adds a figure to Standard No. 221, *School Bus Body Joint Strength*.

The Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Act) mandated the issuance of Federal motor vehicle safety standards for several aspects of school bus performance, Pub. L. 93–492, § 202 (15 U.S.C. § 1392 (i)(1)(A)). These amendments included a definition of school bus that necessitated a revision of the existing definition used by the NHTSA in establishing safety requirements. The Act also specified that the new requirements "apply to each school bus and item of school bus equipment which is manufactured . . . on or after the expiration of the 9-month period which begins on the date of promulgation of such safety standards." (15 U.S.C. § 1392(i)(1)(B)).

Pursuant to the Act, amendments were made to the following standards: Standard No. 301–75, *Fuel System Integrity* (49 CFR 571.301–75), effective July 15, 1976, for school buses not already covered by the standard (40 FR 483521, October 15, 1975); Standard No. 105–75, *Hydraulic Brake Systems* (49 CFR 571.105–75), effective October 12, 1976 (41 FR 2391, January 16, 1976); and Standard No. 217, *Bus Window Retention and Release* (49 CFR 571.217), effective for school buses on October 26, 1976 (41 FR 3871, January 27, 1976).

In addition, the following new standards were added to Part 571 of Title 49 of the Code of Federal Regulations, effective October 26, 1976: Standard No. 220, *School Bus Rollover Protection* (41 F.R. 3874, January 27, 1976); Standard No. 221, *School Bus Body Joint Strength* (41 F.R. 3872, January 26, 1976); and Standard No. 222, *School Bus Passenger Seating and Crash Protection* (41 F.R. 4016, January 28, 1976). Also, the existing definition of "school bus" was amended, effective October 27, 1976, in line with the date set by the Act for issuance of the standards.

The Act was recently amended by Public Law 94–346 (July 8, 1976) to change the effective dates of the school bus standards to April 1, 1977 (15 U.S.C. § 1392(i)(1)(B)). This notice is intended to advise interested persons of these changes of effective dates. In the case of Standard No. 301–75, the change of effective date is reflected in a conforming amendment to S5.4 of that standard. A similar amendment is made in S3 of Standard No. 105–75.

The agency concludes that the October 27, 1976, effective date for the redefinition of "school bus" should be postponed to April 1, 1977, to conform to the new effective dates for the upcoming requirements. If this were not done, the new classes

of school buses would be required to meet existing standards that apply to school buses (e.g., Standard No. 108 (49 CFR 571.108)) before being required to meet the new standards. This would result in two stages of compliance, and would complicate the redesign efforts that Congress sought to relieve.

This notice also amends Standard No. 220 in response to an interpretation request by Blue Bird Body Company, and Sheller-Globe Corporation's petition for reconsideration of the standard. Both companies request confirmation that the standard's requirement to operate emergency exits during the application of force to the vehicle roof (S4(b)) does not apply to roof exits which are covered by the force application plate. The agency did not intend to require the operation of roof exits while the force application plate is in place on the vehicle. Accordingly, an appropriate amendment has been made to S4(b) of the standard.

With regard to Standard No. 220, Sheller-Globe also requested confirmation that, in testing its school buses that have a gross vehicle weight rating (GVWR) of 10,000 pounds or less, it may test with a force application plate with dimensions other than those specified in the standard. The standard does not prohibit a manufacturer from using a different dimension from that specified, in view of the NHTSA's expressed position on the legal effect of its regulations. To certify compliance, a manufacturer is free to choose any means, in the exercise of due care, to show that a vehicle (or item of motor vehicle equipment) would comply if tested by the NHTSA as specified in the standard. Thus the force application plate used by the NHTSA need not be duplicated by each manufacturer or compliance test facility. Sheller-Globe, or example, is free to use a force application plate of any width as long as it can certify its vehicle would comply if tested by the NHTSA according to the standard.

In a separate area, the agency corrects the inadvertent omission of an illustration from Standard No. 221 as it was issued January 26, 1976 (41 F.R. 3872). The figure does not differ from that proposed and, in that form, it received no adverse comment.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 F.R. 16200, April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this action on the public and private sectors, including possible loss of safety benefits. The changes in effective dates for the school bus standards are not evaluated because they were accomplished by law and not by regulatory action.

The change of effective date for the redefinition of "school bus" will result in savings to manufacturers who will not be required to meet existing school bus standards between October 27, 1976, and April 1, 1977. The agency calculates that the only standard that would not be met would be the requirement in Standard No. 108 for school bus marker lamps. In view of the agency's existing provision for the marking of light school buses in Pupil Transportation Standard No. 17 (23 CFR 1204), it is concluded that the absence of this equipment until April 1, 1977, will not have a significant adverse impact on safety.

The interpretative amendment of Standard No. 220 and the addition of a figure to Standard No. 221 are not expected to affect the manufacture or operation of school buses.

In consideration of the foregoing, Part 571 of Title 49 of the Code of Federal Regulations is amended. . . .

Effective dates:

1. Because the listed amendments do not impose additional requirements of any person, the National Highway Traffic Safety Administration finds that an immediate effective date of August 26, 1976 is in the public interest.

2. The effective date of the redefinition of "school bus" in 49 CFR Part 571.3 that was published in the issue of December 31, 1976 (40 F.R. 60033) is changed to April 1, 1977.

3. The effective dates of Standard Nos. 105–75, 217, 301–75, 220, 221, and 222 (as they apply to school buses) are April 1, 1977, in accordance with Public Law 94–346.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Pub. L. 94–346, Stat. (15 U.S.C. § 1392(i)(1)(B)); delegation of authority at 49 CFR 1.50.)

Issued on August 17, 1976.

John W. Snow
Administrator

41 F.R. 36027
August 26, 1976

MOTOR VEHICLE SAFETY STANDARD NO. 220

School Bus Rollover Protection

S1. Scope. This standard establishes performance requirements for school bus rollover protection.

S2. Purpose. The purpose of this standard is to reduce the number of deaths and the severity of injuries that result from failure of the school bus body structure to withstand forces encountered in rollover crashes.

S3. Applicability. This standard applies to school buses.

S4. Requirements. When a force equal to 1½ times the unloaded vehicle weight is applied to the roof of the vehicle's body structure through a force application plate as specified in S5., Test procedures—

(a) The downward vertical movement at any point on the application plate shall not exceed 5⅛ inches; and

(b) Each emergency exit of the vehicle provided in accordance with Standard No. 217 (§ 571.217) shall be capable of opening as specified in that standard during the full application of the force and after release of the force, except that an emergency exit located in the roof of the vehicle is not required to be capable of being opened during the application of the force. A particular vehicle (*i.e.*, test specimen) need not meet the emergency opening requirement after release of force if it is subjected to the emergency exit opening requirements during the full application of the force.

S5. Test procedures. Each vehicle shall be capable of meeting the requirements of S4. when tested in accordance with the procedures set forth below.

S5.1 With any non-rigid chassis-to-body mounts replaced with equivalent rigid mounts, place the vehicle on a rigid horizontal surface so that the vehicle is entirely supported by means of the vehicle frame. If the vehicle is constructed without a frame, place the vehicle on its body sills. Remove any components which extend upward from the vehicle roof.

S5.2 Use a flat, rigid, rectangular force application plate that is measured with respect to the vehicle roof longitudinal and lateral centerlines;

(a) In the case of a vehicle with a GVWR of more than 10,000 pounds, 12 inches shorter than the vehicle roof and 36 inches wide; and

(b) In the case of a vehicle with a GVWR of 10,000 pounds or less, 5 inches longer and 5 inches wider than the vehicle roof. For purposes of these measurements, the vehicle roof is that structure, seen in the top projected view, that coincides with the passenger and driver compartment of the vehicle.

S5.3 Position the force application plate on the vehicle roof so that its rigid surface is perpendicular to a vertical longitudinal plane and it contacts the roof at not less than two points, and so that, in the top projected view, its longitudinal centerline coincides with the longitudinal centerline of the vehicle, and its front and rear edges are an equal distance inside the front and rear edges of the vehicle roof at the centerline.

S5.4 Apply an evenly-distributed vertical force in the downward direction to the force application plate at any rate not more than 0.5 inch per second, until a force of 500 pounds has been applied.

S5.5 Apply additional vertical force in the downward direction to the force application plate at a rate of not more than 0.5 inch per second

until the force specified in S4 has been applied, and maintain this application of force.

S5.6 Measure the downward movement of any point on the force application plate which occurred during the application of force in accordance with S5.5.

S5.7 To test the capability of the vehicle's emergency exits to open in accordance with S4(b)—

(a) In the case of testing under the full application of force, open the emergency exits as specified in S4(b) while maintaining the force applied in accordance with S5.4 and S5.5; and

(b) In the case of testing after the release of all force, release all downward force applied to the force application plate and open the emergency exits as specified in S4(b).

S6. Test conditions. The following conditions apply to the requirements specified in S4.

S6.1 Temperature. The ambient temperature is any level between 32° F. and 90° F.

S6.2 Windows and doors. Vehicle windows, doors, and emergency exits are in fully-closed position, and latched but not locked.

41 F.R. 3874
January 27, 1976

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 221

School Bus Body Joint Strength

(Docket No. 73–34; Notice 3)

This notice establishes a new motor vehicle safety standard, No. 221; *School Bus Body Joint Strength*, 49 CFR 571.221, specifying a minimum performance level for school bus body panel joints.

The Motor Vehicle and Schoolbus Safety Amendments of 1974 (Pub. L. 93–492, 88 Stat. 1470, herein, the Act) require the issuance of minimum requirements for school bus body and frame crashworthiness. This rulemaking is pursuant to authority vested in the Secretary of Transportation by the Act and delegated to the Administrator of the NHTSA, and is preceded by notices of proposed rulemaking issued January 29, 1974 (39 F.R. 2490) and March 13, 1975 (40 F.R. 11738).

One of the significant injury-producing characteristics of school bus accidents, exposure to sharp metal edges, occurs when body panels become separated from the structural components to which they have been fastened. In an accident severe lacerations may result if the occupants of the bus are tossed against these edges. Moreover, if panel separation is great the component may be ejected from the vehicle, greatly increasing the possibility of serious injury.

This standard is intended to lessen the likelihood of these modes of injury by requiring that body joints on school buses have a tensile strength equal to 60 percent of the tensile strength of the weakest joined body panel, as suggested by the Vehicle Equipment Safety Commission (VESC). The NHTSA has determined that this is an appropriate level of performance for body joints and that its application to school buses is both reasonable and practicable. Furthermore, the NHTSA believes that adoption of this standard will provide an effective and meaningful solution to the body panel problem.

It is anticipated that this rule will burden manufacturers only to the extent of requiring the installation of more rivets than are currently used. The NHTSA has reviewed the economic and environmental impact of this proposal and determined that neither will be significant.

In their response to the two NHTSA proposals on this subject, several of the commenters suggested that the standard could be met by reducing the strength of the panel rather than increasing the strength of the joint, and that a minimum joint strength should be required. For several reasons the NHTSA does not believe that a minimum absolute joint strength is desirable at this time. While this standard will tend to increase the overall strength of buses, it is not designed to set minimum body panel strength requirements. Its purpose is to prevent panels from separating at the joint in the event of an accident. In order to deal with the problem of laceration, this regulation must be applicable to both exterior and interior joints. An absolute minimum joint strength requirement would be constrained by the level of performance appropriate for the relatively thin interior panels. Thus, the overall level of performance could not be defined in a meaningful fashion without severely and unnecessarily limiting the manufacturer's flexibility in designing his product. The NHTSA School Bus Rollover Protection Standard (49 CFR 571.220), which specifies requirements for the structural integrity of school bus bodies, should result in a practical lower limit on panel strength and thereby set a practical absolute minimum joint strength.

The NHTSA has no evidence that the mode of failure found in the larger traditional school buses also occurs in smaller, van-type school buses currently manufactured by automobile manufacturers for use as 11- to 17-passenger school buses. Ford Motor Company commented that the mode of injury sought to be prevented by this standard does not occur in accidents involving school buses converted from multipurpose passenger vehicles (vans). Chrysler Corporation suggested that the proposed requirement is inappropriate when applied to vans with "coach" joint construction. Based on these comments, the NHTSA has determined that until information to the contrary appears or is developed these vehicles should not be covered by the requirement. Accordingly, the application of the standard has been limited to school buses with a gross vehicle weight rating over 10,000 pounds.

Several commenters suggested that certain types of joints might not be susceptible of testing in the manner specified in this regulation. Up to this time the NHTSA has not found sufficient evidence in support of that position to justify amending the standard. If information is received indicating that different test methods are required for certain applications, appropriate action will be initiated.

In consideration of the foregoing, a new motor vehicle safety standard, No. 221, *School Bus Body Joint Strength*, is added as § 571.221 of Part 571 of Title 49, Code of Federal Regulations, as set forth below.

Effective date: October 26, 1976.

The effective date of this standard is 9 months after the date of issuance, as required by the Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492, section 202 (15 U.S.C. 1397(i)(1)(A)).

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); § 202, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50.)

Issued on January 22, 1976.

Howard J. Dugoff
Acting Administrator

41 F.R. 3872
January 27, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 221

School Bus Body Joint Strength

(Docket No. 73–3; Notice 7)
(Docket No. 73–20; Notice 10)
(Docket No. 73–34; Notice 4)
(Docket No. 75–2; Notice 3)
(Docket No. 75–3; Notice 5)
(Docket No. 75–7; Notice 3)
(Docket No. 75–24; Notice 3)

This notice announces that the effective dates of the redefinition of "school bus" and of six Federal motor vehicle safety standards as they apply to school buses are changed to April 1, 1977, from the previously established effective dates. This notice also makes a minor amendment to Standard No. 220, *School Bus Rollover Protection*, and adds a figure to Standard No. 221, *School Bus Body Joint Strength.*

The Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Act) mandated the issuance of Federal motor vehicle safety standards for several aspects of school bus performance, Pub. L. 93–492, § 202 (15 U.S.C. § 1392(i)(1)(A)). These amendments included a definition of school bus that necessitated a revision of the existing definition used by the NHTSA in establishing safety requirements. The Act also specified that the new requirements "apply to each schoolbus and item of schoolbus equipment which is manufactured . . . on or after the expiration of the 9-month period which begins on the date of promulgation of such safety standards." (15 U.S.C. § 1392(i)(1)(B)).

Pursuant to the Act, amendments were made to the following standards: Standard No. 301–75, *Fuel System Integrity* (49 CFR 571.301–75), effective July 15, 1976, for school buses not already covered by the standard, (40 F.R. 483521, October 15, 1975); Standard No. 105–75, *Hydraulic Brake Systems* (49 CFR 571.105–75), effective October 12, 1976 (41 F.R. 2391, January 16, 1976); and Standard No. 217, *Bus Window Retention and Release* (49 CFR 571.217), effective for school buses on October 26, 1976 (41 F.R. 3871, January 27, 1976).

In addition, the following new standards were added to Part 571 of Title 49 of the Code of Federal Regulations, effective October 26, 1976: Standard No. 220, *School Bus Rollover Protection* (41 F.R. 3874, January 27, 1976); Standard No. 221, *School Bus Body Joint Strength* (41 F.R. 3872, January 26, 1976); and Standard No. 222, *School Bus Passenger Seating and Crash Protection* (41 F.R. 4016, January 28, 1976). Also, the existing definition of "school bus" was amended, effective October 27, 1976, in line with the date set by the Act for issuance of the standards.

The Act was recently amended by Public Law 94–346 (July 8, 1976) to change the effective dates of the school bus standards to April 1, 1977 (15 U.S.C. § 1392(i)(1)(B)). This notice is intended to advise interested persons of these changes of effective dates. In the case of Standard No. 301–75, the change of effective date is reflected in a conforming amendment to S5.4 of that standard. A similar amendment is made in S3 of Standard No. 105–75.

The agency concludes that the October 27, 1976, effective date for the redefinition of "school bus" should be postponed to April 1, 1977, to conform

to the new effective dates for the upcoming requirements. If this were not done, the new classes of school buses would be required to meet existing standards that apply to school buses (e.g., Standard No. 108 (49 CFR 571.108)) before being required to meet the new standards. This would result in two stages of compilance, and would complicate the redesign efforts that Congress sought to relieve.

This notice also amends Standard No. 220 in response to an interpretation request by Blue Bird Body Company, and Sheller-Globe Corporation's petition for reconsideration of the standard. Both companies request confirmation that the standard's requirement to operate emergency exits during the application of force to the vehicle roof (S4(b)) does not apply to roof exits which are covered by the force application plate. The agency did not intend to require the operation of roof exits while the force application plate is in place on the vehicle. Accordingly, an appropriate amendment has been made to S4(b) of the standard.

With regard to Standard No. 220, Sheller-Globe also requested confirmation that, in testing its school buses that have a gross vehicle weight rating (GVWR) of 10,000 pounds or less, it may test with a force application plate with dimensions other than those specified in the standard. The standard does not prohibit a manufacturer from using a different dimension from that specified, in view of the NHTSA's expressed position on the legal effect of its regulations. To certify compliance, a manufacturer is free to choose any means, in the exercise of due care, to show that a vehicle (or item of motor vehicle equipment) would comply if tested by the NHTSA as specified in the standard. Thus the force application plate used by the NHTSA need not be duplicated by each manufacturer or compliance test facility. Sheller-Globe, for example, is free to use a force application plate of any width as long as it can certify its vehicle would comply if tested by the NHTSA according to the standard.

In a separate area, the agency corrects the inadvertent omission of an illustration from Standard No. 221 as it was issued January 26, 1976 (41 F.R. 3872). The figure does not differ from that proposed and, in that form, it received no adverse comment.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 F.R. 16200, April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this action on the public and private sectors, including possible loss of safety benefits. The changes in effective dates for the school bus standards are not evaluated because they were accomplished by law and not by regulatory action.

The change of effective date for the redefinition of "school bus" will result in savings to manufacturers who will not be required to meet existing school bus standards between October 27, 1976, and April 1, 1977. The agency calculates that the only standard that would not be met would be the requirement in Standard No. 108 for school bus marker lamps. In view of the agency's existing provision for the marking of light school buses in Pupil Transportation Standard No. 17 (23 CFR 1204), it is concluded that the absence of this equipment until April 1, 1977, will not have a significant adverse impact on safety.

The interpretative amendment of Standard No. 220 and the addition of a figure to Standard No. 221 are not expected to affect the manufacture or operation of school buses.

In consideration of the foregoing, Part 571 of Title 49 of the Code of Federal Regulations is amended. . . .

Effective dates:

1. Because the listed amendments do not impose additional requirements of any person, the National Highway Traffic Safety Administration finds that an immediate effective date of August 26, 1976 is in the public interest.

2. The effective date of the redefinition of "school bus" in 49 CFR Part 571.3 that was published in the issue of December 31, 1976 (40 F.R. 60033) is changed to April 1, 1977.

3. The effective dates of Standard Nos. 105–75, 217, 301–75, 220, 221, and 222 (as they apply to school buses) are April 1, 1977, in accordance with Public Law 94–346.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Pub. L. 94–346, Stat. (15 U.S.C. § 1392(i)(1)(B)); delegation of authority at 49 CFR 1.50).

Issued on August 17, 1976.

John W. Snow
Administrator

41 F.R. 36027
August 26, 1976

MOTOR VEHICLE SAFETY STANDARD NO. 221

School Bus Body Joint Strength

S1. Scope. This standard establishes requirements for the strength of body panel joints in school bus bodies.

S2. Purpose. The purpose of this standard is to reduce deaths and injuries resulting from the structural collapse of school bus bodies during crashes.

S3. Application. This standard applies to school buses with gross vehicle weight ratings of more than 10,000 pounds.

S4. Definitions.

"Body component" means a part of a bus body made from a single piece of homogeneous material or from a single piece of composite material such as plywood.

"Body panel" means a body component used on the exterior or interior surface to enclose the bus' occupant space.

"Body panel joint" means the area of contact or close proximity between the edges of a body panel and another body component, excluding spaces designed for ventilation or another functional purpose, and excluding doors, windows, and maintenance access panels.

"Bus body" means the portion of a bus that encloses the bus' occupant space, exclusive of the bumpers, the chassis frame, and any structure forward of the forwardmost point of the windshield mounting.

S5. Requirement. When tested in accordance with the procedure of S6, each body panel joint shall be capable of holding the body panel to the member to which it is joined when subjected to a force of 60% of the tensile strength of the weakest joined body panel determined pursuant to S6.2.

S6. Procedure.

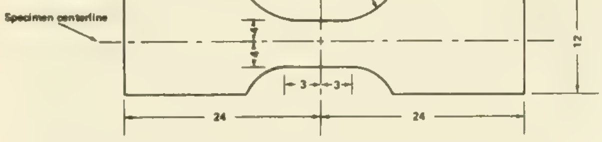
S6.1 Preparation of the test specimen.

S6.1.1 If a body panel joint is 8 inches long or longer, cut a test specimen that consists of any randomly selected 8-inch segment of the joint, together with a portion of the bus body whose dimensions, to the extent permitted by the size of the joined parts, are those specified in Figure 1, so that the specimen's centerline is perpendicular to the joint at the midpoint of the joint segment. Where the body panel is not fastened continuously, select the segment so that it does not bisect a spot weld or a discrete fastener.

S6.1.2 If a joint is less than 8 inches long, cut a test specimen with enough of the adjacent material to permit it to be held in the tension testing machine specified in S6.3.

S6.1.3 Prepare the test specimen in accordance with the preparation procedures specified in the 1973 edition of the Annual Book of ASTM Standards, published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

FIGURE 1



All dimensions in inches

S6.2 Determination of minimum allowable strength. For purposes of determining the minimum allowable joint strength, determine the tensile strengths of the joined body components as follows:

(a) If the mechanical properties of a material are specified by the American Society for Testing and Materials, the relative tensile strength for such a material is the minimum tensile strength specified for that material in the 1973 edition of the Annual Book of ASTM Standards.

(b) If the mechanical properties of a material are not specified by the American Society for Testing and Materials, determine its tensile strength by cutting a specimen from the bus body outside the area of the joint and by testing it in accordance with S6.3.

S6.3 Strength test.

S6.3.1 Grip the joint specimen on opposite sites of the joint in a tension testing machine calibrated in accordance with Method E4, Verification of Testing Machines, of the American Society for Testing and Materials (1973 Annual Book of ASTM Standards).

S6.3.2 Adjust the testing machine grips so that the joint, under load, will be in stress approximately perpendicular to the joint.

S6.3.3 Apply a tensile force to the specimen by separating the heads of the testing machine at any uniform rate not less than ⅛ inch and not more than ⅜ inch per minute until the specimen separates.

41 F.R. 3872
January 27, 1976

PREAMBLE TO MOTOR VEHICLE SAFETY STANDARD NO. 222

School Bus Seating and Crash Protection

(Docket No. 73–3; Notice 5)

This notice establishes a new motor vehicle safety Standard No. 222, *School Bus Seating and Crash Protection*, that specifies seating, restraining barrier, and impact zone requirements for school buses.

The Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492, directed the issuance of a school bus seating systems performance standard (and other standards in seven areas of vehicle performance). The NHTSA had already issued two proposals for school bus seating systems prior to enactment of the 1974 Safety Amendments (the Act) (38 F.R. 4776, February 22, 1973) (39 F.R. 27585, July 30, 1974) and subsequently published two additional proposals (40 F.R. 17855, April 23, 1975) (40 F.R. 47141, October 8, 1975). Each aspect of the requirements was fully considered in the course of this rulemaking activity. Comments received in response to the most recent proposal were limited to a few aspects of the Standard.

The largest number of comments were received on the requirement that school bus passenger seats be equipped with seat belt anchorages at each seating position. The standard relies on compartmentalization between well-padded and well-constructed seats to provide occupant protection on school buses (other than van-type buses). At the same time, seat belt anchorages were proposed so that a greater measure of protection could be gained if a particular user chose to use the anchorages by installation of seat belts together with a system to assure that seat belts would be worn, properly adjusted, and not misused.

Bus operators strongly expressed the view that the presence of seat belt anchorages would encourage the installation of seat belts by school districts without providing the necessary supervision of their use. This association of school bus operators (National School Transportation Association) also questioned the benefits that would be derived from anchorage installation as long as their utilization is not required. In view of these factors, and the indications that in any event only a small fraction of school buses would have belts installed and properly used, the NHTSA concludes that the proposed seat belt anchorage requirement should not be included in this initial school bus seating standard. Further study of the extent to which belts would be installed and properly used should permit more certainty as the basis for any future action.

NHTSA calculations demonstrate that the strength characteristics of the seat specified by the standard to provide the correct amount of compartmentalization also provide the strength necessary to absorb seat belt loads. This means that an operator or school district may safely attach seat belts to the seat frame, even where anchorages are not installed as original equipment. The seat is strong enough to take the force of occupants against the seat back if no belts are utilized, or the force of occupants against seat belts if occupants are restrained by belts attached to the seat frame through the anchorages provided.

The Physicians for Automotive Safety (PAS) requested that lap belts be required in addition to the compartmentalization offered by the seating systems. The agency concluded earlier in this rulemaking procedure that compartmentalization provides satisfactory protection and that a requirement for belts without the assurance of proper supervision of their use would not be an effective means of providing occupant protection.

PAS has not provided data or arguments that would modify this conclusion, and its request is therefore denied.

PAS, relying on testing undertaken at the University of California at Los Angeles in 1967 and 1969, argued that a vertical seat back height of 24 inches above the seating reference point (SRP) is necessary to afford adequate protection against occupant injury. The NHTSA, as noted in its fourth notice of school bus crash protection, based its 20-inch requirement on newer data generated in dynamic and static testing by AMF Corporation of prototype seats designed to meet the proposed requirements of the standard ("Development of a Unitized School Bus", DOT–HS–400969). While the NHTSA does not dispute that a properly constructed, higher seat back provides more protection than a lower seat back, the data support the agency's determination that the 20-inch seat back provides a reasonable level of protection. School bus accident data do not provide substantial evidence of a whiplash injury experience that could justify a 4-inch increase in seat back height. For this reason, the seat back height is made final as proposed.

Several commenters objected to applicability of the standard to school buses with a gross vehicle weight rating (GVWR) of 10,000 pounds or less (light school buses), asserting that the special requirements of the standard for those buses were inappropriate, or unachievable within the 9–month leadtime for compliance mandated by the Act.

Chrysler Corporation requested exclusion of light school buses from this standard for an indefinite period, and Ford Motor Company requested that essentially the same package of standards as already are provided in its van-type multi-purpose passenger vehicles and school bus models be required in the future, with no additional protection. Both companies believe that the relatively small numbers of their vehicles sold as school buses would have to be withdrawn from the market because of the expense of tooling new seating that offers more crash protection than present seating. Wayne Corporation manufactures a light school bus that is not based on a van-type vehicle, and requested that seats used in its larger models be permitted in smaller models, along with seat belts that comply with Standard No. 209.

The Congressional direction to issue standards for school bus seating systems (15 U.S.C. § 1392(i)(1)(A)(iv)) implies that existing seating and occupant crash protection standards are insufficient for vehicles that carry school children. The NHTSA has proposed a combination of requirements for light school buses that differ from those for heavier buses, because the crash pulse experienced by smaller vehicles is more severe than that of larger vehicles in similar collisions. The standard also specifies adequate numbers of seat belts for the children that the vehicle would carry, because such restraints are necessary to provide adequate crash protection in small vehicles. The requirements applicable to light school buses are considered reasonable, and are therefore included in the final rule as proposed.

In Wayne's case, it is not clear why the seat it has developed for heavier school buses will not serve in its smaller school buses. Seat belts may need to be attached to the floor to support the force specified by Standard No. 210 for anchorages. Also, some interior padding may be necessary to meet the vehicle impact zone requirements of S5.3.1.1(a).

Sheller-Globe Corporation (Sheller) and Wayne considered unreasonable the standard's limitation on maximum distance between a seat's SRP and the rear surface of the seat or restraining barrier forward of the SRP (S5.2). The limitation exists to minimize the distance an occupant travels before forward motion is arrested by the padded structure that compartmentalizes the occupant. The two bus manufacturers contend that they must also comply with State requirements for a minimum distance between seats that results in only 1 inch of tolerance in seating placement.

Section 103(d) of the National Traffic and Motor Vehicle Safety Act provides in part:

(d) Whenever a Federal motor vehicle safety standard . . . is in effect, no State or political subdivision of a State shall have any authority either to establish or continue in effect, with respect to any motor vehicle or item of motor vehicle equipment any safety standard appli-

cable to the same aspect of performance of such vehicle or item of equipment which is not identical to the Federal standard.

It is the opinion of the NHTSA that any State requirement relating to seat spacing, other than one identical to the Federal requirement for maximum spacing of 20 inches from the SRP, is preempted under § 103(d), 15 U.S.C. § 1392(d).

Sheller advocated wider seat spacing for activity buses, because seats are occupied for longer periods of time on road trips. The NHTSA, noting that activity buses are often used on the open highway at high speeds for long periods of time, requests comments on the advisability of specifying a seat belt requirement in place of the seat spacing requirement in the case of these buses.

Much of Sheller and Wayne's concern over tolerances may stem from a misunderstanding of the meaning of "seating reference point" (SRP). As defined by the NHTSA (49 CFR 571.3), the SRP is essentially the manufacturer's design reference point which simulates the pivot center of the human torso and thigh, located in accordance with the SAE Standard J826. Thus the manufacturer calculates, on its seat design seen in side projected view, the pivot center of the human torso and thigh of the potential seat occupant, and then establishes a design reference point that simulates the location of the actual pivot center. The NHTSA has interpreted that this design reference point may be fixed by the manufacturer with reference to the seating structure to simplify calculation of its location in a bus for purposes of measurement and compliance.

Sheller also requested that the "seat performance forward" testing be simplified by eliminating the 8-inch range of locations at which the lower loading bar can be applied against the seat back. As noted in the preamble to Notice 4 of this docket in response to a similar request from Blue Bird Body Company, the NHTSA declines to make this restriction, to discourage the addition of a narrow 2-inch wide structural member at this point simply to meet the requirement. This reasoning remains valid and Sheller's request is denied.

Sheller also asked that the requirement for forward-facing seats be eliminated from the standard, in view of the practice of installing side-facing seats in some buses for handicapped students. The NHTSA designed the seating system in this standard for protection from fore and aft crash forces, and considers it necessary that the seats be forward-facing to achieve the objective of occupant protection. Comments are solicited on whether the provision of this protection in special vehicles is impractical.

The Vehicle Equipment and Safety Commission (VESC) asked for a minimum seat width of 13 inches for each designated seating position, noting that the standard's formula permits seating of 12.67 inches in width. The agency does not believe its standard will encourage seats narrower than those presently provided in school buses, but will watch for any indication that that is occurring. Action can be taken in the future if it appears that seating is being designed to be narrower than at present.

In consideration of the foregoing, a new motor vehicle safety Standard No. 222, *School Bus Seating and Crash Protection*, is added as § 571.222, of Part 571 of Title 49, Code of Federal Regulations. . . .

Effective date: October 26, 1976. The effective date of this standard is established as 9 months after the date of its issuance, as required by the Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492, section 202 (15 U.S.C. 1397(i)(1)(A)).

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); § 202, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50).

Issued on January 22, 1976.

Howard J. Dugoff
Acting Administrator

41 F.R. 4016
January 28, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 222

School Bus Seating and Crash Protection

(Docket No. 73–3; Notice 6)

This notice responds to two petitions for reconsideration of Standard No. 222, *School Bus Passenger Seating and Crash Protection*, as it was issued January 22, 1976.

Standard No. 222 (49 CFR 571.222 was issued January 22, 1976 (41 F.R. 4016, January 28, 1976), in accordance with § 202 of the Motor Vehicle and Schoolbus Safety Amendments of 1974, Pub. L. 93–492 (15 U.S.C. § 1392(i)(1)) and goes into effect on October 26, 1976. The standard provides for compartmentalization of bus passengers between well-padded and well-constructed seats in the event of collision. Petitions for reconsideration of the standard were received from Sheller-Globe Corporation and from the Physicians for Automotive Safety (PAS), which also represented the views of Action for Child Transportation Safety, several adult individuals, and several school bus riders.

PAS expressed dissatisfaction with several aspects of the standard. The organization objected most strongly to the agency's decision that seat belts should not be mandated in school buses. PAS disagreed with the agency conclusion (39 F.R. 27585, July 30, 1974) that, whatever the potential benefits of safety belts in motor vehicle collisions, the possibility of their non-use or misuse in the hands of children makes them impractical in school buses without adequate supervision. In support of safety belt installation, PAS cited statistics indicating that 23 percent of reported school bus accidents involve a side impact or rollover of the bus.

While safety belts presumably would be beneficial in these situations, PAS failed to provide evidence that the belts, if provided, would be properly utilized by school-age children. The agency will continue to evaluate the wisdom of its decision not to mandate belts, based on any evidence showing that significant numbers of school districts intend to provide the supervision that should accompany belt use. In view of the absence of evidence to date, however, the agency maintains its position that requiring the installation of safety belts on school bus passenger seats is not appropriate and denies the PAS petition for reconsideration. The agency continues to consider the reduced hostility of improved seating to be the best reasonable form of protection against injury.

PAS asked that a separate standard for seat belt assembly anchorages be issued. They disagree with the agency's conclusion (41 F.R. 4016) that seat belt anchorages should not be required because of indications that only a small fraction of school buses would have belts installed and properly used. However, PAS failed to produce evidence that a substantial number of school buses would be equipped with safety belts, or that steps would be taken to assure the proper use of such belts. In the absence of such information, the agency maintains its position that a seat belt anchorage requirement should not be included in the standard at this time, and denies the PAS petition for reconsideration.

The NHTSA does find merit in the PAS concern that in the absence of additional guidance, improper safety belt installation may occur. The Administration is considering rulemaking to establish performance requirements for safety belt anchorages and assemblies when such systems are installed on school bus passenger seats.

PAS also requested that the seat back height be raised from the 20-inch level specified by the standard to a 24-inch level. In support of this position, the organization set forth a "common

sense" argument that whiplash must be occurring to school bus passengers in rear impact. However, the agency has not been able to locate any quantified evidence that there is a significant whiplash problem in school buses. The crash forces imparted to a school bus occupant in rear impact are typically far lower than those imparted in a car-to-car impact because of the greater weight of the school bus. The new and higher seating required by the standard specifies energy absorption characteristics for the seat back under rear-impact conditions, and the agency considers that these improvements over earlier seating designs wil reduce the number of injuries that occur in rear impact. For lack of evidence of a significant whiplash problem, the PAS petition for a 24-inch seat back is denied.

PAS believed that the States and localities that specify a 24-inch seat back height would be precluded from doing so in the future by the preemptive effect of Standard No. 222 under § 103(f) of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. § 1392(f)):

> § 103 * * * * *
>
> (d) Whenever a Federal motor vehicle safety standard under this subchapter is in effect, no State or political subdivision of a State shall have any authority either to establish, or to continue in effect, with respect to any motor vehicle or item of motor vehicle equipment any safety standard applicable to the same aspect of performance of such vehicle or item of equipment which is not identical to the Federal standard. Nothing in this section shall be construed to prevent the Federal Government or the government of any State or political subdivision thereof from establishing a safety requirement applicable to motor vehicle equipment procured for its own use if such requirement imposes a higher standard of performance than that required to comply with the otherwise applicable Federal standard.

Standard No. 222 specifies a minimum seat back height (S5.1.2) which manufactures may exceed as long as their product conforms to all other requirements of the standards applicable to school buses. It is the NHTSA's opinion that any State standard of general applicability concerning seat back height of school bus seating would also have to specify a minimum height identical to the Federal requirement. Manufacturers would not be required to exceed this minimum. Thus, the PAS petition to state seat back height as a minimum is unnecessary and has already been satisfied, although it does not have the effect desired by the PAS.

With regard to the PAS concern that the States' seat height requirements would be preempted, the second sentence of § 103(d) clarifies that the limitation on safety regulations of general applicability does not prevent governmental entities from specifying additional safety features in vehicles purchased for their own use. Thus, a State or its political subdivisions could specify a seat back height higher than 20 inches in the case of public school buses. The second sentence does not permit these governmental entities to specify safety features that prevent the vehicle or equipment from complying with applicable safety standards.

With regard to which school buses qualify as "public school buses" that may be fitted with additional features, it is noted that the agency includes in this category those buses that are owned and operated by a private contractor under contract with a State to provide transportation for students to and from public schools.

Sheller-Globe Corporation (Sheller) petitioned for exclusion from the seating requirements for seating that is designed for handicapped or convalescent students who are unable to utilize conventional forward-facing seats. Typically, side-facing seats are installed to improve entry and egress since knee room is limited in forward-facing seats, or spaces on the bus are specifically designed to accommodate wheelchairs. The standard presently requires that bus passenger seating be forward-facing (S5.1) and conform to requirements appropriate for forward-facing seats. Blue Bird Body Company noted in a March 29, 1976, letter that it also considered the standard's requirements inappropriate for special seating.

The agency has considered the limited circumstances in which this seating would be offered in school buses and concludes that the seat-spacing requirement (S5.2) and the fore-and-aft seat performance requirements (S5.1.3, S5.1.4) are not

appropriate for side-facing seats designed solely for handicapped or convalescent students. Occupant crash protection is, of course, as important for these students as others, and the agency intends to establish requirements suited to these specialized seating arrangements. At this time, however, insufficient time remains before the effective date of this standard to establish different requirements for the seating involved. Therefore, the NHTSA has decided to modify its rule by the exclusion of side-facing seating installed to accommodate handicapped or convalescent passengers.

School bus manufacturers should note that the limited exclusion does not relieve them from providing a restraining barrier in front of any forward-facing seat that has a side-facing seat or wheelchair position in front of it .

Sheller also petitioned for a modification of the head protection zone (S5.3.1.1) that describes the space in front of a seating position where an occupant's head would impact in a crash. The outer edge of this zone is described as a vertical longitudinal plane 3.25 inches inboard of the outboard edge of the seat.

Sheller pointed out that van-type school buses utilize "tumble home" in the side of the vehicle that brings the bus body side panels and glazing into the head protection zone. As Sheller noted, the agency has never intended to include body side panels and glazing in the protection zone. The roof structure and overhead projections from the interior are included in this area of the zone. To clarify this distinction and account for the "tumble home," the description of the head impact zone in S5.3.1.1 is appropriately modified.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 F.R. 16201; April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this action on the public and private sectors, including possible loss of safety benefits. The decision to withdraw requirements for side-facing seats used by handicapped or convalescent students will result in cost savings to manufacturers and purchasers. The action may encourage production of specialized buses that would otherwise not be built if the seating were subject to the standard. Because the requirements are not appropriate to the orientation of this seating, it is estimated that no significant loss of safety benefits will occur as a result of the amendment. The exclusion of sidewall, window or door structure from the head protection zone is simply a clarification of the agency's longstanding intent that these components not be subject to the requirements. Therefore no new consequences are anticipated as a result of this amendment.

In an area unrelated to the petitions for reconsideration, the Automobile Club of Southern California petitioned for specification of a vandalism resistance specification for the upholstery that is installed in school buses in compliance with Standard No. 222. Data were submitted on experience with crash pads installed in school buses operated in California. Vandalism damage was experienced, and its cost quantified in the submitted data.

The Automobile Club made no argument that the damage to the upholstery presents a significant safety problem. While it is conceivable that removal of all padding from a seat back could occur and expose the rigid seat frame, the agency estimates that this would occur rarely and presumably would result in replacement of the seat. Because the agency's authority under the National Traffic and Motor Vehicle Safety Act is limited to the issuance of standards that meet the need for motor vehicle safety (15 U.S.C. § 1392(a)), the agency concludes that a vandalism resistance requirement is not appropriate for inclusion in Standard No. 222.

In light of the foregoing, Standard No. 222 (49 CFR 571.222) is amended. . . .

Effective date: October 26, 1976. Because the standard becomes effective on October 26, 1976, it is found to be in the public interest that an effective date sooner than 180 days is in the public interest. Changes in the text of the Code of Federal Regulations should be made immediately.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on July 7, 1976.

James B. Gregory
Administrator

41 F.R. 28506
July 12, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 222

School Bus Seating and Crash Protection

(Docket No. 73–3; Notice 8)

This notice amends Standard No. 222, *School Bus Passenger Seating and Crash Protection*, to delay the effective date for maximum rearward deflection of seats from April 1, 1977, to April 1, 1978.

Standard No. 222 (49 CFR 571.222), as published January 28, 1976 (41 F.R. 4016), established October 27, 1976, as the effective date of the standard, as mandated by the Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Act) (Pub. L. 93–492). Congress subsequently amended the Act by Public Law 94–346 (July 8, 1976) to extend the effective date for the implementation of school bus standards to April 1, 1977.

The NHTSA has promulgated regulations on several aspects of performance mandated by Congress in the Act. These regulations become effective on April 1, 1977. The agency concludes, however, that compliance with one provision of Standard No. 222 by the April 1, 1977, effective date would be impracticable, would result in substantial economic waste, and would not be in the public interest.

Since publication of Standard No. 222, a misunderstanding has arisen within the industry concerning the definition of the term "absorbed" when used in connection with the requirements in sections S5.1.3.4 and S5.1.4.2. The NHTSA explained the term "absorbed" in an interpretation to Thomas Built Buses (July 30, 1976) to mean "receive without recoil." This interpretation requires that returned energy be subtracted from total energy applied to the seat back to calculate energy "absorbed" by the seat back.

School bus manufacturers tested their seats in accordance with the NHTSA definition of "absorbed" and found that the seats continued to comply with the requirements of Standard No. 222 when tested for forward performance (S5.1.3), but these same seats were marginally below the NHTSA requirements for rearward seat deflection. Based upon these test data, petitions have been received from Thomas Built Buses, Blue Bird Body Company, Carpenter Body Works, Wayne Corporation, and Ward School Bus Manufacturing, all requesting a change in rearward performance requirements.

The NHTSA has examined the data submitted by the manufacturers and concludes that the seats upon which the tests were made demonstrate a high probability of meeting most of the requirements of Standard No. 222. Further, the agency concludes that to mandate full compliance with the rearward performance requirements of Standard No. 222 would require extensive retooling and redesign. This could result in substantial economic waste of seats now in production and severe economic hardship for manufacturers.

The NHTSA is particularly concerned that to require full compliance with the rearward performance requirements at this late date might mean that manufacturers would be unable to redesign their seats in time to commence manufacture of completed buses on April 1, 1977. Since single-stage buses produced after April 1, 1977, must meet NHTSA safety requirements in all other respects, they will be substantially safer than buses currently in use. Therefore, the agency finds that it is in the interest of safety to ensure that these safer buses will be available on April 1, 1977, to replace older less safe models. To ensure that safer buses can be marketed without delay, the NHTSA extends the effective date of requirements for maximum rearward deflection of seats to April 1, 1978. It is emphasized

that the numerous other requirements for school bus seating, including all other rearward performance requirements, remain in effect, which ensures adequate interior protection as of April 1, 1977, as mandated by Congress. A proposal for minor modification of S5.1.4 (to be published shortly) will permit reinstitution of rearward deflection requirements following the 1-year delay.

Because of the imminent effective date of the school bus safety standards and the lead time required to modify seat design, the NHTSA for gool cause finds that notice and public procedure on this amendment are impracticable and contrary to the public interest.

In consideration of the foregoing, S5.1.4(b) of Standard No. 222 (49 CFR 571.222) is amended by the addition, at the beginning of the first sentence, of the following phrase: "In the case of a school bus manufactured on or after April 1, 1978,".

Effective date: December 16, 1976. Because this amendment relieves a restriction and does not impose requirements on any person, it is found, for good cause shown, that an immediate effective date is in the public interest.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 202, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50.)

Issued on December 10, 1976.

Acting Administrator
Charles E. Duke

41 F.R. 54945
December 16, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 222

(Docket No. 73–3; Notice 12)

This notice amends Standard No. 222, *School Bus Passenger Seating and Crash Protection*, increasing the allowable rearward deflection of seats from 8 to 10 inches. The action is taken in response to petitions that indicated the current rearward deflection requirement is unnecessarily restrictive in that it would require costly retooling of school bus seats with no measurable safety advantage over a somewhat greater deflection distance that would not entail significant retooling. Additionally, a minor modification of the standard is made clarifying the meaning of "absorbed energy" consistent with an agency interpretation of that term.

Effective Date: April 1, 1978.

For further information contact:

Mr. Timothy Hoyt, Crashworthiness Division, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202–426–2264).

Supplementary Information: On November 10, 1977, the NHTSA published a notice proposing to amend the rearward deflection requirement of Standard No. 222, *School Bus Passenger Seating and Crash Protection*. The impetus for that proposal came from several petitions from school bus manufacturers claiming that the rearward deflection requirement was unnecessarily restrictive since it would require significant retooling of school bus seats which would not be measurably superior, in terms of safety, to seats designed to meet a slightly greater deflection distance. They stated that seats produced in compliance with a somewhat greater rearward deflection requirement, as opposed to the currently specified 8-inch requirement, would not require retooling. The NHTSA agreed with the petitioners and, accordingly, proposed to increase the allowable rearward deflection of seats from 8 to 10 inches. By the same notice, the NHTSA proposed a minor modification of the standard clarifying the agency's meaning of absorbed energy.

Only one comment was received in response to that notice of proposed rulemaking. The Vehicle Equipment Safety Commission did not submit comments.

The only commenter, Blue Bird Body Company, took issue with the agency's proposed method for limiting rearward seat deflection. It asserted that the requirement expressed in S5.1.4 (c) of the standard should be the only limitation on rearward seat deflection. That section provides that a seat shall not, when tested, come within 4 inches of any portion of another passenger seat.

Blue Bird's comment is not persuasive. The requirement of S5.1.4(c) addresses an entirely separate safety concern than the requirement of S5.1.4(b). Section S5.1.4(b) limits the rearward deflection of a seat, by this notice, to a maximum of 10 inches. That requirement functions as part of the compartmentalization scheme of Standard 222. Limiting the degree of seat back deflection helps to contain a child within the seat structures in the event of an accident. This requirement should be distinguished from that contained in S5.1.4(c), which is intended to ensure that a minimum amount of space remains between seats following an accident so that a child does not become trapped. Since both requirements are necessary to maintain the safety level considered necessary for school buses, Blue Bird's request is denied.

Blue Bird stated in its comments a preference for specifying maximum rearward seat deflection in terms of inches rather than angle. This comment suggests that Blue Bird misinterpreted the statements in the notice of proposed rulemaking as indicating that the NHTSA was contemplat-

ing an amendment that would limit the angle of seat deflection. The reference in the notice to a 40° seat angle was made only to justify the proposed 10-inch maximum seat deflection. A 40° seat angle roughly translates to 10 inches of rearward seat deflection. There was no intention to suggest that an angle limitation was under consideration. In fact, the preamble stated that the NHTSA had abandoned, in earlier rulemaking, attempts to adopt an angular measurement owing to the difficulty of making such a measurement.

The agency concludes that the extension of the allowable rearward deflection of seats from 8 to 10 inches assures passenger safety while minimizing the cost impact of compliance with the school bus regulations. Since this amendment relieves a restriction, it should result in no increase in costs.

In consideration of the foregoing, Part 571, of Title 49, CFR, is amended. . . .

The principal authors of this proposal are Timothy Hoyt of the Crashworthiness Division and Roger Tilton of the Office of Chief Counsel.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 203, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50.)

Issued on March 1, 1978.

Joan Claybrook
Administrator

43 F.R. 9149
March 6, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 222

School Bus Seating and Crash Protection

(Docket No. 73–3; Notice 13)

Action: Final rule.

Summary: This notice makes final an existing interim amendment to Standard No. 222, *School Bus Seating and Crash Protection*, increasing the maximum allowable seat spacing in school buses from 20 to 21 inches. In issuing the original standard, the agency intended that the seats be spaced approximately 20 inches apart (S5.2). However, because of manufacturing tolerances, some school bus manufacturers were spacing their seats at distances less than 20 inches to ensure that the spacing does not exceed the prescribed maximum. A seat spacing specification of 21 inches permits 20-inch spacing of seats by taking manufacturing tolerances into fuller account. This spacing will accommodate large high school students while still ensuring a safe level of school bus seat performance.

Effective date: Since this amendment merely makes final an existing interim rule, it is effective March 29, 1979.

For further information contact:

Mr. Robert Williams, Crashworthiness Division, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202) 426–2264.

Supplementary information: On December 22, 1977, the National Highway Traffic Safety Administration issued a proposal to increase the allowable seat spacing in school buses from 20 to 21 inches (42 FR 64136). Concurrently with that proposal, the NHTSA issued an interim final rule permitting buses to be constructed immediately with the increased seat spacing (42 FR 64119). This action was taken to provide the amount of seat spacing in school buses originally intended by the agency and to relieve immediately problems created by the unnecessarily limited seat spacing in buses then being built. The action resulted from numerous complaints by school bus users relating to seat spacing. The proposal and interim final rule responded to petitions from the Wisconsin School Bus Association and the National School Transportation Association asking for increased seat spacing.

The agency received many comments in response to its December 1977 proposal. Most comments favored some extension in the seat spacing allowance in school buses. Commenters differed as to the amount of seat spacing needed to accommodate fully the larger school children. Some commenters suggested that the agency provide still more seat spacing than proposed in the December 22 notice. Other commenters supported the agency's suggested modification.

The agency has reviewed all of the comments and the petitions concerning this issue and has concluded that the proposal and interim rule provide sufficient seat spacing in school buses for all school children. To provide greater seat spacing, as suggested by some commenters, might necessitate changing the seat structures to absorb more energy. See the December proposal for further discussion of this point. The NHTSA does not believe that such a costly change is warranted at this time. The agency notes that as a result of the interim rule seat spacing in buses has become adequate to meet the needs for pupil transportation to and from school. The agency continues, however, to research the proper seating for activity buses and will address that issue in a separate notice as soon as all of the research and analysis is completed.

In accordance with the foregoing, Volume 49 of the Code of Federal Regulations, Part 571, Standard No. 222, *School Bus Seating and Crash Protection*, is amended . . . .

The principal authors of this notice are Robert Williams of the Crashworthiness Division and Roger Tilton of the Office of Chief Counsel.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 203, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392); delegation of authority at 49 CFR 1.50.)

Issued on March 21, 1979.

Joan Claybrook
Administrator

44 F.R. 18674–18675
March 29, 1979

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 222

Federal Motor Vehicle Safety Standards; School Bus Passenger Seating and Crash Protection

[Docket No. 73-3; Notice 15]

ACTION: Final rule.

SUMMARY: This notice amends the agency's school bus seating standard to increase seat spacing from 21 to 24 inches. This amendment is being issued to resolve problems experienced by users, i.e., school districts and contract carriers, to the effect that mandatory seat spacing at the prior level inhibited some necessary uses. The agency finds that an additional space seating option will not inhibit safety.

DATE: This amendment is effective March 24, 1983.

SUPPLEMENTARY INFORMATION: Standard No. 222, *School Bus Passenger Seating and Crash Protection*, was one of several standards implemented pursuant to the Motor Vehicle and School Bus Safety Amendments of 1974 (Pub. L. 93-492). The standard regulates the performance aspects of school bus seats. One portion of the standard limits the longitudinal spacing between seats in buses with gross vehicle weight ratings (GVWR) of more than 10,000 pounds. No seat may be positioned more than 21 inches from the seat immediately to the front, measured from the seating reference point to the seat back or restraining barrier located in front of the seat.

The initial version of Standard 222 which became effective on April 1, 1977, limited school bus seat spacing to 20 inches. Soon after school buses began to be produced in compliance with this requirement, users began to experience problems of inadequate spacing. Because of quality control and other production problems affecting seat spacing, manufacturers were spacing seats significantly less than the 20 inches permitted by the standard to ensure compliance. As manufacturers improved their production techniques, seat spacing was extended.

The agency upon examination of its then existing data concluded later that same year that it could extend seat spacing to 21 inches without adversely affecting the compartmentalization concept that was the key to protecting children in the buses. Compartmentalization attempts to protect children between well padded high-backed seats. The agency amended the rule accordingly (42 F.R. 64119, December 22, 1977) and undertook to study further the appropriateness of the required seat spacing.

Both the amendment and improved manufacturer production methods reduced the number of spacing problems significantly. Some problems continue to exist, however, especially concerning buses used to transport children long distances to and from school, or to and from school related events which may be located far from the school itself. The agency has conducted tests to see whether it could improve seat spacing to respond to these continuing problems, without compromise of safety. The tests, which are available in the Technical Reference Section of the agency under H73-3 "School Bus Passenger Seat and Lap Belt Sled Tests," DOT-HS-804985, December 1978, show that seat spacing could be increased up to 24 inches without impairing the concept of compartmentalization. An increase in seat spacing beyond 24 inches might impair the ability of the seats to absorb energy in the manner required by the standard. Accordingly,

on February 25, 1982, the agency proposed a further increase in seat spacing to 24 inches (47 F.R. 8231).

The agency received numerous comments in response to the notice of proposed rulemaking. Virtually all of those comments supported the agency's action. In accordance with the comments and the existing agency information, the agency, by this notice, makes final the increased seat spacing to 24 inches.

Three school districts out of the more than 140 commenters on the February notice objected to the increased seat spacing. It appears that these commenters were afraid that the increased seat spacing was mandatory and that this would in turn reduce the seating capacity in their vehicles resulting in the need to purchase additional buses or realign school routes. This understanding is not accurate. The increased seat spacing is merely optional. If a school chooses to have additional spacing in some or all of its buses, up to 24 inches, this would be permitted. Otherwise, schools may continue to purchase buses with seats spaced as they are today. Seat spacing less than 24 inches is completely within the discretion of the school that is purchasing the vehicles.

Commenters to the February notice raised another issue that is somewhat related to seat spacing. They requested more comfortable seats and additional leg room for long distance school buses. These are the vehicles that frequently have been involved in transporting children to and from activities or, in some instances, carry children over long distances to schools in some of the Western States. The commenters in general would prefer to have recliner seats or some other seating system that would be more comfortable for these uses.

The agency has explored the possibility of establishing another optional seating mode in school vehicles that would accommodate the concerns of these commenters. The agency concludes that recliner seats could not provide the same level of safety as provided by existing seat requirements in school buses. Accordingly, the agency declines to adopt this suggestion. NHTSA believes that the seat spacing extension being made today should address adequately the problem of comfort in buses used for school activities.

This amendment is being made effective immediately. It relieves a restriction, and is completely optional, and does not require any manufacturer or purchaser to alter present practices. Further, the agency has learned that many companies and purchasers are waiting for this amendment before purchasing new vehicles. Therefore, an immediate effective date is in the public interest.

Issued on March 17, 1983.

Raymond A Peck, Jr.
Administrator
48 F.R. 12384
March 24, 1983

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 222

Seat Belt Assembly Achorages
(Docket No. 87-08; Notice 5)
RIN: 2127-AD12

ACTION: Final rule.

SUMMARY: This rule establishes a new requirement for lap/shoulder safety belts to be installed in all forward-facing rear outboard seating positions in convertible passenger cars, light trucks and multipurpose passenger vehicles (e.g., passenger vans and utility vehicles), and small buses. Rear-seat lap/shoulder belts are estimated to be even more effective than rear-seat lap-only belts in reducing fatalities and moderate-to-severe injuries. As safety belt use in the rear seat of these vehicle types increases, the greater effectiveness of rear-seat lap/shoulder belts should yield progressively greater safety benefits. NHTSA also anticipates that this rule will achieve benefits by helping to increase safety belt use in rear seating positions of these vehicle types, by providing rear-seat occupants with maximum safety protection when they buckle up.

This rule also establishes a requirement for lap/shoulder belts to be installed at the driver's seat and at any other front outboard seating position in small buses. NHTSA believes that lap/shoulder safety belts in these small buses will offer the same benefits as lap/shoulder belts in those positions offer to occupants of passenger cars, light trucks, and light multipurpose passenger vehicles.

EFFECTIVE DATE: The amendments of S7.1.1.3 and S7.1.1.5 are effective on September 1, 1991. All the other amendments made by this rule take effect on May 1, 1990. These requirements apply to convertible passenger cars, light trucks, light multipurpose passenger vehicles, and small buses manufactured on or after September 1, 1991. Convertible passenger cars, light trucks, light multipurpose passenger vehicles, and small buses manufactured before September 1, 1991 may also comply with these requirements.

SUPPLEMENTARY INFORMATION: ***Background.*** On January 1, 1968, the initial Federal Motor Vehicle Safety Standards took effect. One of those standards was Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208), which required the installation of lap/shoulder safety belts at the driver's and right front passenger's seating positions of passenger cars, and either lap-only or lap/shoulder safety belts at every other designated seating position. Another of the initial safety standards that took effect on January 1, 1968 was Standard No. 210, *Seat Belt Assembly Anchorages* (49 CFR 571.210), which specified location and strength requirements for the anchorages used to hold the safety belts to the passenger car during a crash. Standard No. 210 required passenger car manufacturers to provide anchorages for lap/shoulder belts for each forward-facing front *and* rear outboard seating position in all cars other than convertibles. NHTSA subsequently amended both of these standards to extend their applicability to trucks, multipurpose passenger vehicles (MPVs), and buses. However, when Standard No. 210 was extended to these additional vehicle types, NHTSA did not require the manufacturers to provide upper torso (i.e., shoulder belt) anchorages for rear outboard seating positions in these other vehicle types or in convertible passenger cars.

Studies of occupant protection from 1968 forward show that the lap-only safety belts installed in rear seating positions are effective in reducing the risk of death and injury. See, for example, the studies cited in the ANPRM on this subject; 52 FR 22820, June 16, 1987. However, the agency believes that rear-seat lap/shoulder safety belts would be even more effective. NHTSA estimates that rear-seat lap-only belts reduce the risk of death by 24-40 percent, while rear-seat lap/shoulder belts reduce that risk by 32-50 percent. The somewhat greater effectiveness of lap/shoulder belts vs. lap-only belts in the rear seat results in progressively greater actual safety benefits for rear-seat occupants, to the extent that those safety belts are, in fact, used. As recently as 1981-82, only two percent of rear-seat occupants used their safety belts. At that level of belt use, there are very few safety benefits from requiring rear-seat lap/shoulder belts instead of lap-only belts. However, belt use in the rear seat has steadily risen, with 16 percent of rear seat occupants buckling up in 1987. As rear-seat belt use continues to rise, the incremental benefits of rear-seat lap/shoulder belts can be realized.

The increase in belt use in rear seats was one of the factors reflected in the agency's decision to grant a petition by the Los Angeles Area Child Passenger Safety Association asking NHTSA to establish a requirement for rear-seat lap/shoulder safety belts. After granting this petition, NHTSA published an advance notice of proposed rulemaking (ANPRM) on June 16, 1987 (52 FR 22818). Thirty-four commenters responded to the ANPRM's request for comments on the need for rulemaking action to require lap/shoulder safety belts in rear seating positions.

After considering these comments, NHTSA concluded that several factors had changed since the agency had previously examined this issue and determined that it was appropriate to give vehicle manufacturers the option of installing either lap-only belts or lap/shoulder belts in rear seats. Among the changed factors were the substantial increase in rear seat safety belt use and the substantial decrease in costs of a requirement for rear-seat lap/shoulder belts, because of manufacturers voluntarily equipping more and more of their vehicles with rear seat lap/shoulder belts. After analyzing the effects of these changed factors and the comments on the ANPRM, NHTSA tentatively determined that a requirement for lap/shoulder belts would now be appropriate. Accordingly, NHTSA published a notice of proposed rulemaking (NPRM) on November 29, 1988 (53 FR 47982).

This NPRM was a comprehensive proposal that proposed requirements for passenger cars and light trucks, MPVs, and small buses to be equipped with lap/shoulder safety belts at all forward-facing rear outboard seating positions. Additionally, the NPRM proposed that these lap/shoulder safety belts be equipped with a particular type of retractor, that such belts be integral (i.e., the shoulder belt could not be detachable from the lap belt), and that such belts comply with some of the comfort and convenience requirements specified in section S7.4 of Standard No. 208.

More than 70 comments were received on this NPRM. The issue of whether passenger cars other than convertibles would be equipped with rear seat lap/shoulder belts was straightforward and noncontroversial, with only two commenters suggesting some modifications of the agency's proposal to require all 1990 and subsequent model year passenger cars to be equipped with rear-seat lap/shoulder belts. To ensure the earliest possible implementation of a requirement for rear-seat lap/shoulder belts in passenger cars, on June 14, 1989, NHTSA published a final rule addressing only those vehicles (54 FR 25275). That rule requires rear-seat lap/shoulder belts in all passenger cars manufactured on or after December 11, 1989.

This rule addresses all of the other issues that were presented in the November, 1988 NPRM on this topic. For the convenience of the reader, this rule uses the same organization and format as the NPRM did.

Requirements of this Rule

1. Seating Positions Subject to These Requirements

The NPRM proposed that lap/shoulder belts be required in rear seats at outboard seating positions *only*. Some commenters suggested that technologies and designs are available to provide lap/shoulder belts at rear center seating positions, and that NHTSA should further examine this issue. The agency explained in the NPRM that there are more technical difficulties associated with any requirement for lap/shoulder belts at center rear seating positions, and that lap/shoulder belts at center rear seating positions would yield small safety benefits and substantially greater costs, given the lower center seat occupancy rate and the more difficult engineering task. Accordingly, this rulemaking excluded further consideration of a requirement for center rear seating positions. None of the commenters presented any new data that would cause the agency to change its tentative conclusion on this subject that was announced in the NPRM.

The NPRM also noted that seating positions adjacent to aisleways in some vans might not be "outboard designated seating positions" as defined at 49 CFR § 571.3, because those aisle seats could be more than 12 inches from the inside of the vehicle. General Motors (GM) stated its belief that this discussion showed the agency's intent to exclude seats that border aisleways from the lap/shoulder belt requirement. GM suggested that the reasons for excluding these seating positions from the lap/shoulder belt requirement were the costs and/or practical difficulties that would be presented if aisleway seating positions were required to be equipped with lap/shoulder belts. Specifically, GM stated that locating the anchorage for the upper end of the shoulder belt on the aisle side of the vehicle would stretch the shoulder belt across the aisleway and cause entry and exit problems for occupants of seating positions to the rear of the aisleway seating position. To avoid such difficulties, the anchorage for the upper end of the shoulder belt could be moved to the roof of the vehicle. However, roof structural modifications would have to be made to accommodate the anchorage, and these modifications would impose disproportionately high costs. GM stated in its comments that these reasons would apply with equal force to all seats adjacent to aisleways, regardless of whether such seats were more than or less than 12 inches from the inside of the vehicle.

NHTSA has determined that these comments have merit. The agency did not mean to suggest that shoulder belts should be required at seating positions where they would obstruct an aisle designed to give access to rear seating positions. Accordingly, this rule has been modified from the proposal to specify that these rear-seat lap/shoulder belt requirements apply

to rear outboard seating positions *except* any outboard seating positions that are adjacent to a walkway located between the seat and the side of the vehicle to allow access to more rearward seating positions. Of course, in those cases where manufacturers are able to design and install lap/shoulder belts at seating positions adjacent to aisleways without interfering with the aisleway's purpose of allowing access to more rearward seating positions, NHTSA encourages the manufacturers to do so. It should also be noted that those rear seating positions at which lap/shoulder belts are not installed voluntarily or in response to a regulatory requirement *are required* by Standard No. 208 to be equipped with lap-only safety belts, which have been proven effective in reducing the risk of death and injury.

2. Types of Rear Seats Subject to These Requirements

The NPRM proposed limiting these requirements to *forward-facing* rear outboard seats, because the agency is unaware of any data showing that occupants of center-facing or rear-facing seating positions would be significantly better protected by lap/shoulder belts than by lap-only belts. The NPRM also referred to an April 8, 1988 letter to Mr. Ohdaira of Isuzu Motors, in which NHTSA stated that S7.1.1 of Standard No. 208 requires safety belts on swivel seats installed at *front* outboard seating positions to adjust to fit occupants "with the seat in any position." Because the same regulatory language would apply to swivel seats installed at *rear* outboard seating positions if the proposal were adopted as a final rule, the NPRM proposed to add express regulatory language to S7.1.1 to codify the interpretation.

Three commenters responded to this discussion in the NPRM. Ford, Nissan, and Toyota raised substantially the same points in their comments. These commenters all suggested that the agency ought to require swivel seats to provide lap/shoulder belts for occupants when the seats are forward-facing, but permit occupants to be restrained by lap-only belts when the swivel seats are adjusted to some position other than forward-facing. These manufacturers argued that the overall protection of upper torso restraints (i.e., shoulder belts) on occupants of center-facing seating positions is unclear. For example, in certain instances, the design standard in Australia *prohibits* manufacturers from providing upper torso restraints at center-facing seating positions. Further, these manufacturers stated that they knew of no crash data suggesting the need for such a requirement. According to these commenters, the absence of demonstrable safety benefits associated with such a requirement combined with the demonstrable technological problems and costs associated with such a requirement should lead the agency to require only lap belts when swivel seats are adjusted to a position other than forward-facing.

NHTSA was persuaded by these comments. Indeed, as Ford noted in its comments, just as the NPRM stated that no data show that occupants of center-facing or rear-facing seats would be significantly better protected by lap/shoulder belts instead of lap-only belts, no data show that occupants of swivel seats adjusted to the center-facing or rear-facing positions would be significantly better protected by lap/shoulder belts instead of lap-only belts. Accordingly, this final rule adds language to Standard No. 208 that requires swivel seats to provide lap/shoulder belts for occupants when the seat is adjusted to the forward-facing position and permits swivel seats to provide lap-only belts for occupants when the seat is adjusted to some position other than forward-facing. The Ohdaira interpretation is, therefore, overruled to the extent that it is inconsistent with this new language in Standard No. 208.

In its comments, Ford indicated that it would be appropriate for this preamble to discuss a type of seat Ford is considering installing in future vehicle models. This seat was described as a bench seat that converts from forward-facing to rear-facing. Under the language added to Standard No. 208 by this rule, all seats that can be adjusted to a forward-facing position and some other position, regardless of whether such seats are swivel seats, convertible seats of the sort described in Ford's comment, or any other such seat, must provide lap/shoulder belts when in the forward-facing position and may provide lap-only belts when adjusted to some position other than forward-facing.

3. Vehicle Types Subject to These Requirements

a. Passenger Cars

In the NPRM, the agency proposed to make the requirement for rear seat lap/shoulder belts apply to *all* passenger cars, including convertibles. As previously discussed, the requirements for passenger cars other than convertibles were published in a June 14, 1989 final rule (54 FR 25275). The NPRM proposed that rear seat lap/shoulder belts be required on convertible passenger cars manufactured on or after September 1, 1991.

In its comments, Volkswagen asked for an additional year of leadtime, until September 1, 1992, before rear seat lap/shoulder belts must be installed in convertible passenger cars. According to this commenter, the convertible version of its Golf model (the Cabriolet) is not currently equipped with rear seat lap/shoulder belts, was not originally designed to accommodate such belts, and will need substantial modifications to its current design if the car is to accommodate such belts.

No change has been made in response to this comment. The NPRM noted that it was more difficult to install rear seat lap/shoulder belts in convertibles than in other passenger cars, but that, in spite of these difficulties, at least three different manufacturers had rear-seat lap/shoulder belts in their 1988 model year convertibles. Accordingly, the agency proposed to require convertible passenger cars to be equipped with rear-seat lap/shoulder belts, but to allow two years more leadtime than was proposed for other passenger cars, in recognition of the greater technical difficulties. Volkswagen's comment appears to be that more than two years of additional leadtime is needed to overcome the greater technical difficulties associated with convertibles, although the comment does not include any explanation or analysis of why this is so. A manufacturer's unsubstantiated desire for additional leadtime is not a sufficient basis for the agency to postpone the proposed September 1, 1991 effective date for rear seat lap/shoulder belts in convertibles. Therefore, this rule adopts the proposed requirement.

b. Light Multipurpose Passenger Vehicles.

This vehicle type consists primarily of passenger vans with a seating capacity of 10 persons or less and utility vehicles and other off-road vehicles. None of the commenters suggested any particular problems that a requirement for rear-seat lap/shoulder belts would impose on MPVs in general. Toyota repeated its position that the voluntary installation of rear-seat lap/shoulder belts by manufacturers in all vehicle types made it unnecessary for NHTSA to proceed with this rulemaking. NHTSA responded at length to similar comments by the vehicle manufacturers in the preamble to the NPRM; *see* 53 FR 47984.

Ford did not object to the proposed general requirement for rear-seat lap/shoulder belts in light MPVs, but asked that open-body type MPVs be excluded from the requirement. Ford explained its comment by stating that its Bronco II utility vehicle has a removable roof over the rear passenger and cargo area. According to Ford's comments, "Because the removable roof on this vehicle extends below the shoulder reference point, it would be impossible to obtain a good shoulder belt fit if the shoulder belt anchorages were to be located on the non-removable side panels of the vehicle." For these reasons, Ford suggested that open-body type MPVs be exempted from these requirements or that the proposed requirements be revised to make clear that rear-seat lap/shoulder belts are not required in open-body type MPVs when the roof is removed.

NHTSA agrees with Ford's assertions that open-body type MPVs present greater technical difficulties for the installation of rear seat lap/shoulder belts than other MPVs or convertible passenger cars. For example, the rear seats are closer to the rear of the vehicle and the rear seats are higher in relation to the vehicle floor and sides in most open-body type MPVs than in most convertible passenger cars. The agency concurs with Ford's assertion that these factors tend to make the shoulder belt geometry more difficult in open-body type MPVs. However, the agency does not believe that these factors present insurmountable engineering difficulties. Instead, NHTSA believes that these problems can be solved in a relatively straightforward manner. While manufacturers cannot use the exact same designs used for convertible passenger cars on open-body type MPVs, the convertible passenger car designs can be modified for use in open-body type MPVs. NHTSA concludes that if it is practicable to offer the increased protection of shoulder belts at rear outboard seating positions, and the added costs are comparable to the costs for other MPVs and convertible passenger cars, there is no reason to exclude open-body type MPVs from the requirement for rear seat lap/shoulder belts in MPVs. Hence, no change has been made to the proposed requirements for MPVs in response to this comment by Ford.

The agency notes that this means that lap/shoulder belts will be required in the rear outboard seats of open-body type MPVs, while lap-only belts will be permitted in front outboard seats of those vehicles. (In practice, however, manufacturers have voluntarily provided front-seat lap/shoulder belts in these vehicles.) NHTSA is in the process of re-examining the occupant protection requirements for the front seating positions in open-body type MPVs and other light trucks and vans, with particular consideration of whether automatic occupant protection should be required in these vehicles. NHSTA will address the discrepancy between the regulatory requirements for front and rear seat occupant protection in open-body type MPVs in the course of that re-examination.

c. Light Trucks and Small Buses

All commenters that addressed the proposed requirements for rear-seat lap/shoulder belts in light trucks supported the proposal. Similarly, no commenters raised any objections to the proposed rear-seat lap/shoulder belt requirements in small buses *other than school buses.* Thus, those proposed requirements are adopted, for the reasons explained in the NPRM.

However, several commenters, primarily school bus manufacturers and operators, objected to the proposed requirements for rear-seat lap/shoulder belts in small school buses. Thomas Built, a school bus manufacturer, questioned the effectiveness of rear-seat lap/shoulder belts in certain small school buses ("body on chassis" buses). The Connecticut Operators of School Trans-

portation Association (COSTA) also questioned the effectiveness of lap/shoulder belts in small school buses, by voicing concerns about how the additional stress on the side walls of a small school bus would affect its compliance with Standard No. 221, *School Bus Body Joint Strength* (49 CPR 571.221). Thomas Built also raised the issue of different levels of safety protection for passengers on small school buses, with lap/shoulder belts for outboard seating positions and lap-only belts for the the inboard seating positions. The National School Transportation Association (NSTA) likewise objected to the different levels of occupant protection that would result if some seating positions were equipped with lap/shoulder belts while others were equipped with lap-only belts. Blue Bird, another school bus manufacturer, raised similar objections, claiming that NHTSA occupant protection standards for school buses are "disorganized and confusing," and suggested that the agency undertake rulemaking to separate the occupant protection requirements for school buses from the occupant protection standards for passenger cars and light trucks. Additionally, Blue Bird argued that the requirements proposed in the NPRM would require too many varieties of occupant protection for small school buses.

NHTSA is concerned if Blue Bird or any other school bus manufacturer is having difficulty understanding the occupant protection requirements applicable to the different types of vehicles that can be used to transport school children. A brief summary of those requirements might be helpful. If school systems use a nine or fewer passenger vehicle to transport school children, that vehicle is not a "school bus" for the purposes of the Federal motor vehicle safety standards. Accordingly, that vehicle is not subject to any of the requirements in Standard No. 222, *School Bus Passenger Seating and Crash Protection* (49 CFR § 571.222). Instead, that vehicle would have to comply with the applicable requirements in Standard No. 208. As a result of this rule published today and the agency's previous rulemaking, all front and rear outboard seating positions, in nine-passenger light vehicles must be equipped with lap/shoulder safety belts, *irrespective* of whether the nine-passenger light vehicle is classified as a passenger car, truck, or an MPV.

If the vehicle used to transport school children can accommodate 10 or more passengers, the vehicle is a "school bus" for the purposes of the Federal motor vehicle safety standards. Every vehicle that is a "school bus" must comply with the occupant protection requirements of Standard No. 222. In the case of school buses with a gross vehicle weight rating (GVWR) of more than 10,000 pounds, no safety belts are required at seating positions other than the driver's seat. Instead, Standard No. 222 sets forth requirements that protect occupants of rear seating positions in large school buses by means of a concept called "compartmentalization." Persons interested in learning more about the concept of compartmentalization and occupant protection in large school buses may wish to review the agency's notice terminating rulemaking to specify installation requirements for voluntarily installed safety belts on large school buses. This notice was published March 22, 1989 at 54 FR 11765.

In the case of school buses with a GVWR of 10,000 pounds or less, Standard No. 222 requires that occupants be protected *both* by safety belts at seating positions other than the driver's seat *and* by most of the features of compartmentalization. This double means of occupant protection reflects the more severe "crash pulse" or deceleration experienced by lighter vehicles as compared with heavier vehicles in similar collisions. Sections S5(b) of Standard No. 222 requires that small school buses meet the requirements of Standard No. 208 as those requirements apply to MPVs. The provisions of Standard No. 208 currently require MPVs (and small school buses, since the requirements for these two vehicle types are linked) to be equipped with lap/shoulder safety belts at front outboard seats and either lap/shoulder belts or lap-only belts at all other seating positions.

Upon further consideration, NHTSA has determined that the occupant protection requirements for small school buses should be considered separately, not as an aspect of the rulemaking action. In the past, NHTSA has recognized the special importance of issues related to school buses by examining many of those issues in rulemaking actions focused exclusively on school buses, instead of examining those issues as one part of a rulemaking addressing many types of vehicles. This policy has allowed both the agency and the public to consider fully the implications of any proposed action on school buses safety. NHTSA believes it is appropriate to continue following this policy. Accordingly, this rule continues to permit small school buses to be equipped with either lap-only or lap/shoulder safety belts at all rear seating positions, but small school buses must also comply with most of the compartmentalization requirements for large school buses. All other small buses will be required to be equipped with rear-seat lap/shoulder safety belts, but will not be required to comply with the compartmentalization requirements.

The NPRM acknowledged that small buses other than school buses are not currently required to have lap/shoulder safety belts at front outboard seating positions, even though front seats generally present a more hostile crash environment than rear seats. As noted above, small school buses are subject to the occupant protection requirements for MPVs, and small MPVs have long been required to have lap/shoulder safety belts at front outboard seating positions. No

commenters suggested any reasons why front-seat lap/shoulder belts should not be required in small buses, just as they are required in small school buses. This rule adopts such a requirement.

4. Vehicle Types NOT Subject to These Requirements

a. Vehicles with a GVWR of More Than 10,000 Pounds

NHTSA has traditionally used GVWRs as dividing lines for the purposes of applying occupant crash protection standards. These groupings reflect the differences in the vehicles' functions and crash responses and exposure. The NPRM proposed to use such a dividing line by limiting the rear seat lap/shoulder belt requirements to vehicles with a GVWR of 10,000 pounds or less. No commenters addressed this issue, and this rule adopts the proposal.

b. Motor Homes

The NPRM proposed to exclude vehicles that are "motor homes" from the rear-seat lap/shoulder belt requirements, because lap/shoulder belts at rear seating positions might interfere with the residential purposes of those seats and because the agency had no evidence of significant potential benefits from lap/shoulder belts, instead of the currently permitted option for lap/shoulder or lap-only belts, at these seating positions. The NPRM also proposed a specific definition of "motor home." These proposed requirements are adopted in this rule.

5. Retractor Types Required for Rear Seat Lap/Shoulder Belts

Retractors at Driver's Seat in Small Buses.

The NPRM proposed to require that the lap/shoulder belt assembly installed at the driver's seating position of small buses include an anti-cinch automatic locking retractor (ALR) on the lap belt portion. Both Ford and Chrysler objected to this proposed requirement, stating that it would preclude the use of the continuous loop lap/shoulder belt system in small buses. The continuous loop system, currently used on most manual lap/shoulder belt systems in passenger cars, uses a single emergency locking retractor (ELR) on one end of the belt system and the other end of the belt system is fixed. The ELR then retracts both the lap and shoulder belt portions of the belt system. Ford and Chrysler each commented that they currently use a continuous loop system for the lap/shoulder belts that they voluntarily install at the front outboard seating positions of their small buses, and that they knew of no safety justification for a requirement that would prohibit the use of continuous loop system in small buses, as the proposed requirement for an ALR for the lap belt would have the effect of doing. NHTSA was persuaded by these comments. This rule has been amended to permit the belt systems at front outboard seating positions in small buses to be equipped with either an ELR or an anti-cinch ALR for the lap belt portion.

Retractors for Rear Seats and Child Safety Seats

The NPRM contained a detailed discussion of the agency's previous statements on this subject, and repeated the agency's previous conclusion that *only* ELRs should be permitted as the retractor for the lap belt portion of the lap/shoulder belt system. See 53 FR 47987-47989; November 29, 1988. The agency's conclusion was based on the fact that ELRs for the lap belt made the belt system more comfortable and convenient for adult occupants, thereby tending to increase use of the belt system. Although active children can make some child restraint systems unstable if the child restraint is secured by a lap belt that incorporates an ELR, NHTSA knew of no data to show that this potential instability would affect the safety performance of the child restraint in motor vehicle crashes. Those parents that wanted to eliminate the potential instability of child restraints, even if the instability did not have any demonstrable effect on safety, could purchase locking clips. These locking clips can prevent movement of belts equipped with an ELR.

NHTSA received many comments on this discussion and the accompanying proposal. Many pediatricians and other medical professionals, as well as advocates of child safety, associations representing the insurance industry, and manufacturers of child safety seats, commented that it was important that the belt system in the vehicle be capable of tightly securing a child seat, without resort to any additional hardware like locking clips. The commenters suggested differing means of achieving this end. Some of these commenters advocated that this rule should specify the use of only ALRs in the lap belt portion, because ALRs automatically tighten down to secure the child seat. Other of these commenters, such as the Los Angeles Area Child Passenger Safety Association, urged the agency to draft this rule to require the use of convertible retractors similar to those installed in some General Motors vehicles. These convertible retractors function as ELRs normally, to ensure comfort for adult occupants. When the belt webbing is fully extended, however, the retractors convert to ALRs, to tightly secure child seats. Other of these commenters suggested that the agency could ensure that these rear-seat lap/shoulder belt systems would tightly secure child seats by following the course of action being considered for recommendation by a Society of Automotive Engineers (SAE) Task Force. That task force may recommend that safety belts which incorporate ELRs in the lap belt or lap belt portion of a belt assembly shall include a means for locking the lap belt when it is used with a child seat. Instead of specifying

the use of some specific technology, like ALRs or convertible retractors, this approach sets forth the desired goal and permits manufacturers to use any available technology to achieve that goal.

Some of the vehicle manufacturers, such as Nissan and Toyota, believe that there is no need for any further requirements. According to these commenters, and persons wishing to secure a child seat at a seating position whose lap belt is equipped with ELR can cause the retractor to perform like an ALR simply by using a locking clip. Volvo commented that the agency ought to permit the use of a continuous loop lap/shoulder belt. Volvo asserted that its design of the continuous loop system uses friction at the loop in the buckle to achieve an effect similar to that which would be obtained by using a locking clip. In Volvo's opinion, this lap/shoulder belt system is the best means of both securing child safety seats and ensuring comfort for other occupants of the belt system. Chrysler commented that it was considering modifications to the buckle latchplate as a means of accomplishing the same effect as would locking clips for its belt assemblies equipped with ELRs.

NHTSA has reached the following conclusions after reexamining the available information in light of these comments. Nothing in these comments or the available information shows that low-speed movement of child safety seats actually reduces to any significant extent the effectiveness of those seats in crashes. However, the low-speed movement of child safety seats held by lap belts that use an ELR seems to have given rise to questions and concerns about the safety and effectiveness of child seats when used with a belt that incorporates an ELR. Even if these questions and concerns have not been substantiated, the public may not be as likely to use child safety seats if there are perceived questions about the effectiveness of those seats. NHTSA has concluded that it is appropriate to take action to remove these perceived questions, so as to maintain public trust and confidence in the efficacy of child seats.

The agency was persuaded by the comments asserting that it would be unnecessarily restrictive to require the use of ALRs on the lap belt portion of rear seat lap/shoulder belts, because there are design features other than incorporating an ALR that are as effective in ensuring that the belt system can tightly secure a child safety seat and because such a feature could reduce safety belt use by adult occupants. NHTSA has devised an approach in this final rule that will ensure comfort for adult occupants and tight securing of child safety seats. First, this rule requires that any lap belt or lap belt portion of a lap/shoulder belt installed at an outboard designated seating position in compliance with Standard No. 208 shall be equipped with an ELR. This requirement will take effect on September 1, 1991 for passenger cars, as well as the vehicle types addressed in this rule.

Second, this final rule requires that safety belts that incorporate an ELR in the lap belt or lap belt portion of a lap/shoulder belt shall provide some means other than an external device that requires manual attachment or activation that will prevent any further webbing from spooling out until that means is released or deactivated. This requirement will also take effect on September 1, 1991 for passenger cars and vehicle types addressed in this rule. The purpose of this requirement is to ensure that child safety seats can be tightly secured. This requirement will *not* allow vehicle manufacturers to provide "locking clops" to comply with this requirement. However, any means that can function without additional manual actions can satisfy this requirement. For instance, the convertible retractors on some GM vehicles would comply with this requirement. Additionally, devises like Volvo's are acceptable if those devices do not require any further manual actions to prevent webbing spool out. This approach is intended to allow vehicle manufacturers the freedom to choose whatever approach they prefer to prevent webbing spool out for ELRs, while ensuring that whatever approach is chosen will be effective.

6. The Requirements With Which Rear Seat Lap/Shoulder Belts Must Comply

The NPRM did not propose to require any crash testing requirements for rear-seat lap/shoulder belts, for several reasons. First, neither dummy positioning procedures nor testing procedures for rear seat occupants have yet been developed. In fact, the rear seats are generally removed from vehicles when conducting compliance testing for occupant protection for the front seating positions, to allow the specified weight distribution to be more easily achieved and to permit the installation of additional instrumentation. Second, the rear seating positions offer a generally more benign crash environment than the front seating positions. Accordingly, the agency concluded that it could not justify delaying a proposal for rear-seat lap/shoulder belts until it was able to propose a requirement for dynamic testing of those safety belts. Several commenters stated that they agreed with the agency's decision not to delay this rulemaking, but suggested that the agency ought to move expeditiously to establish crash testing requirements for rear seat occupants. NHTSA will consider these comments when it establishes its priorities for future activities in the area of occupant protection.

As an adjunct to the decision not to require crash testing of rear-seat lap/shoulder belts, the agency proposed to require that rear-seat lap/shoulder belts be

integral. Section S4.1.2.3.1 of Standard No. 208 specifies that manual safety belts installed at front outboard seating positions must be either (a) integral lap/shoulder belts or (b) crash-tested lap-only belts such that the car complies with the occupant protection requirements with test dummies restrained only by the lap belts. However, since the agency cannot at this time promulgate any crash testing requirements for rear-seat safety belts, NHTSA believes it is appropriate to require that rear-seat lap/shoulder belts installed in compliance with this rule be integral; i.e., the lap belt must not be detachable from the shoulder belt.

Several commenters suggested that the requirement for integral lap/shoulder belts should not apply to certain types of seats or vehicles, because of special difficulties posed for those seats or vehicles. In response to these comments, NHTSA has carefully reexamined it proposal to require that *all* rear seat lap/shoulder belts installed in compliance with this rule be integral. The agency prefers to retain the proposed requirement, for the same reasons that the requirement was proposed. That is, to the extent that the lap belt is detachable from the shoulder belt and the lap belt is used without the shoulder belt, the enhanced safety protection offered by lap/shoulder belts will not be achieved. The agency's responses to the comments suggesting that there are some seating positions or vehicles in which rear outboard lap/shoulder belts should not be required to be integral are as follows:

a. Convertible Passenger Cars. ASC, Inc., a company that converts hardtops into convertibles, commented that it did not believe that rear-seat lap/shoulder belts installed in convertibles should be required to be integral. According to ASC's comments, a detachable shoulder belt that is not buckled would still offer the occupant the protection of the lap-only belt. While this comment is true, the purpose of this rulemaking is to ensure that rear-seat occupants will enjoy even greater safety protection than is afforded by lap-only belts. Detachable shoulder belts would not serve this purpose.

ASC's comment then asserted that "the detachability feature is essential for ASC to continue to manufacture at a competitive price a majority of its present convertible production which is already equipped with three point lap-shoulder safety belts." Accordingly, ASC believed that a requirement for integral rear-seat lap/shoulder belts would have a "significant negative impact on its business." The agency has previously stated that it is typically more difficult to install rear-seat lap/shoulder belts in convertibles than in sedans or coupes. However, the 1988 convertible models produced by BMW, Mercedes-Benz, and Saab were all equipped with *integral* lap/shoulder belts at rear outboard seating positions. These voluntary actions by convertible manufacturers showed that the technical difficulties associated with integral rear seat lap/shoulder belts in convertibles can be overcome. It may well cost ASC, Inc. or other converters more to equip a convertible with integral rear-seat lap/shoulder belts than it would cost a high volume manufacturer. However, ASC provided no data or cost estimates that would permit the agency to estimate the cost differential for rear-seat lap/shoulder belts installed by high volume manufacturers and converters. Based on the available information, NHTSA concludes that it is unlikely that any such cost differential would have more than an insignificant effect on the demand for convertibles produced by converters.

NHTSA repeats it previous acknowledgements that it will cost manufacturers more to equip convertibles with integral rear seat lap/shoulder belts than it will cost to equip sedans and coupes with those safety belts. In its comments, Volkswagen stated that it would have to incur tooling costs of $1.2 million to install integral rear-seat lap/shoulder belts in its convertibles, with variable costs of an additional $60 per vehicle to install integral lap/shoulder belts instead of lap-only belts. NHTSA estimates that these costs would result in a consumer cost increase of $90 per vehicle. Even accepting these costs as accurate, NHTSA does not believe that a $90 cost increase for convertibles, which already cost substantially more than the hardtop version of the same vehicle, will have any *significant* negative impacts on the demand for convertibles, even those produced by converters.

To the extent that these costs result in some relatively minor economic impacts, the agency concludes that those costs and impacts are reasonable. The occupants of rear seating positions in convertibles are exposed to at least the same degree of risk of death and injury in a motor vehicle crash as occupants of rear seating positions in other light vehicles. In these circumstances, NHTSA has concluded it is appropriate to provide those occupants with the same amount of safety protection. Therefore, a requirement that convertible passenger cars manufactured on or after September 1, 1991 be equipped with integral lap/shoulder belts at rear outboard seating positions is adopted as proposed.

Fiat filed comments on behalf of Ferrari to the effect that it was possible to comply with the requirement for integral lap/shoulder belts for convertibles that were designed to include those safety belt systems. However, Fiat asserted that the steps needed to modify an existing convertible design to accept the upper anchorages for rear seat lap/shoulder belts "would be financially intolerable." Fiat asked that this final rule be structured to provide an exemption for at least two years for existing convertible designs "which cannot be made to comply without extreme economic and technical hardships." NHTSA has not done so. Section 123 of the Safety Act (15 U.S.C. 1410) and 49 CFR Part 555 set forth procedures for obtaining temporary exemptions from any of the generally applicable re-

quirements set forth in the safety standards. If Fiat is statutorily eligible for such an exemption and can make the requisite showings, it can obtain the temporary exemption it seeks in accordance with those statutory and regulatory requirements.

b. Readily Removable Seats. In the NPRM for this rule, the agency summarized Ford's comment to the ANPRM asserting that lap/shoulder belts installed for readily removable seats should be permitted to be nonintegral, since that would be more convenient for persons using the vehicle especially with the seats removed. NHTSA concurred with this assertion, but noted that permitting detachable shoulder belts would result in lower usage of the shoulder belts and lower safety benefits for this rule. The agency suggested that manufacturers are capable of designing an integral lap/shoulder belt system that is nearly as convenient as safety belt systems with nonintegral shoulder belts. The NPRM suggested: "For instance, a shoulder belt that is readily detachable at the anchorage could be used for the outboard seating positions." 53 FR 47990, November 29, 1988.

Both Ford and GM suggested in their comments that permitting belts to be detachable at the upper anchorage would ease the problems of providing integral lap/shoulder belts at outboard seating positions of readily removable seats. However, both these commenters also stated that a March 1, 1985 interpretation letter from NHTSA's Chief Counsel to Mr. Hiroshi Shimizu of Tokai Rika Co. appeared to state that the provisions of Standard No. 208 forbid the use of a lap/shoulder safety belt that is detachable at the upper anchorage.

Mr. Shimizu provided a diagram with his letter that illustrated the safety belt design in question. This diagram showed two reasons why this design would not comply with the requirements of Standard No. 208. First, because of the location of the retractor and the separate buckles for the lap and shoulder belt portions of this belt system, an occupant could release the shoulder belt buckle and use this system soley as a lap belt with no dangling shoulder belt webbing to alert the occupant to the need to fasten the shoulder belt buckle. Alternatively, an occupant could release the lap belt buckle and use the system solely as a shoulder belt with no dangling webbing to alert the occupant to the need to fasten the lap belt buckle. NHTSA stated that this design would not satisfy the requirement in S4.1.2.3.1 and S4.2.2 of Standard No. 208 the *non-detachable* shoulder belts be provided on some belt assemblies.

Second, section S7.2 of Standard No. 208 requires that the latch mechanism of seat belt assemblies shall release both lap and shoulder belt simultaneously and release at a single point by a pushbutton action. When both the lap and shoulder belt portions of Mr. Shimizu's design were buckled, the occupant would have to release both buckles to get out of the belt system. Hence, this belt system could not comply with Standard No. 208 because the release from the lap and shoulder belt would not be simultaneous, nor would it be at a single point.

NHTSA does not believe that the Shimizu interpretation forecloses all safety belt system designs that detach at the upper anchorage. The language of section S7.2 plainly requires that any such safety belt system must use a single, pushbutton buckle that releases the occupant from the lap belt and shoulder belt simultaneously. There is nothing inherent in the design of a safety belt system detachable at the upper anchorage that makes it impossible to comply with these requirements. Similarly, a shoulder belt could be detachable at the upper anchorage without incorporating an additional point at which the belt could be released by the seat occupant, such as the buckle in Mr. Shimizu's design. For example, manufacturers could install some type of spring operated "dog leash" device that would not be equipped with a push button release mechanism. By a "dog leash" device, NHTSA is referring to a device that does not use any form of push button release. Such devices rely on other actions such as a slide button or slide collar to mechanically uncouple the belt system from the upper anchorage. Such a design would not be prohibited by Standard No. 208 nor anything in the Shimizu interpretation. To make this more clear, this rule adopts language in Standard No. 208 expressly stating that vehicles with readily removable rear seats may use a shoulder belt that detaches at the upper anchorage point to meet the requirements for an integral rear-seat lap/shoulder belt.

c. Swivel seats. As previously noted, swivel seats and other seats that can be adjusted to be forward-facing and to face some other direction will be required to provide lap/shoulder belts only when in the forward-facing position and may provide lap-only belts when adjusted to face other directions. The agency had to consider the question of what requirements should be specified for the detachable shoulder belt. NHTSA could have required those belts to be detachable at the upper anchorage point, by establishing requirements such as were established for readily removable seats. However, that would have left the occupant of the swivel seat with webbing in his or her lap every time the occupant adjusted the seat to some position other than forward-facing. The shoulder belt webbing could become soiled, so that the occupant of the swivel seat not use either the lap belt alone or the belt as a lap/shoulder belt.

To prevent this, NHTSA has decided that seats that adjust to be forward-facing and to face in some other direction are the only rear outboard seating positions

that will *not* be required to be equipped with integral lap/shoulder belts. Instead, those seating positions may be equipped with a shoulder belt that is detachable at the latchplate.

However, this rule establishes an additional requirement that any such non-integral shoulder belt portion be equipped with an ELR, so that the shoulder belt portion will be available for use by all occupants of the seat in its retracted position, and will be less likely to become soiled. This will ensure that those occupants of adjustable seating positions that want the added protection of a lap/shoulder belt in these seating positions will have that protection.

The agency acknowledges that this requirement is likely to result in lower shoulder belt use at these seating positions than at other rear outboard seating positions. However, the agency concludes that belt use at these adjustable seating positions would be lower still if the agency were to require that the lap/shoulder belts be integral and the shoulder belt webbing were in the occupant's lap or on the floor of the vehicle. On balance, the agency concludes that the interests of occupants of adjustable rear seating positions will be best served by permitting the shoulder belt portion of the lap/shoulder belt system to be detachable at the buckle, i.e., non-integral, while including a requirement for a shoulder belt retractor so that a lap shoulder belt will always be available for those persons.

7. Comfort and Convenience

The NPRM stated that compliance with the provisions in S7.4.2(a), S7.4.3, S7.4.4, and S7.4.5 of Standard No. 208 is determined with reference to a test dummy for the front seating positions. As noted above, there are no dummy positioning procedures for the rear seating positions, so the agency cannot determine compliance with the comfort and convenience provisions with reference to a test dummy. Additionally, the NPRM announced that the agency has not yet developed any alternative surrogate measurements for comfort and convenience in rear seating positions. As was the case with crash testing requirements discussed above, NHTSA did not believe it would be appropriate to delay this rulemaking to allow the agency to develop a full set of comfort and convenience requirements.

NHTSA noted that the requirements in S7.4.6 for seat belt guides and hardware would apply to rear-seat lap/shoulder belts without proposing any changes to accomplish that. No commenters objected to this result, so safety belts installed in compliance with this rule are subject to those requirements.

The remaining issue in this area concerned tension-relieving devices on rear-seat lap/shoulder belts. In the NPRM, the agency expressed its tenative conclusion that the same considerations should apply to rear seating positions with tension-relieving devices on safety belts as already apply to front seating positions with tension-relieving devices on safety belts. That is, tension-relieving devices are permitted to be installed on front seat safety belts if vehicles that have tension-relieving devices at those seating positions comply with certain special conditions intended to reduce the likelihood of misuse of tension-relieving devices. Those special conditions are set forth in S7.4.2 as follows:

1. The vehicle owner's manual must include an explanation of how the tension-relieving device works and recommend a maximum amount of slack that should be introduced into the belt under normal circumstances (S7.4.2(b);

2. The vehicle must comply with the injury criteria specified in S5.1 of Standard No. 208 during a barrier crash test with the shoulder belt webbing adjusted to introduce the maximum amount of slack recommended by the manufacturer (S7.4.2(c);

3. The vehicle must have an automatic means to cancel any shoulder belt slack introduced into the belt system by a tension-relieving device (S7.4.2(c).

The NPRM explained that the second requirement listed above could not be applied to rear seat lap/shoulder belts, because the agency could not develop dynamic testing procedures for the rear seating positions at this time. However, the notice proposed to apply the other two requirements listed above to rear-seat lap/shoulder belts equipped with tension-relieving devices.

None of the commenters addressed the proposal to require the vehicle owner's manual to include an explanation of how the tension-relieving device works and a recommendation of the maximum amount of slack to be introduced into the safety belt. Hence, that requirement is adopted as proposed, for the reasons explained in the NPRM.

In its comments, GM objected to the proposed requirement for automatic cancellation of slack. GM indicated that automatic cancellation of slack in front-seat lap/shoulder belts is accomplished by either of two means. If the retractor is mounted on the floor or on the pillar near the adjacent door, the manufacturer generally uses a simple cable, which operates when the door is open to cancel the slack. If there are dual spool retractors on the safety belt system, a simple mechanical device triggered by retraction of the lap belt is used to cancel the slack in the shoulder belt. According to GM, "cable routing concerns" make it difficult to use a cable and the current size of dual spool retractors precludes the use of that technology in rear seating positions. This comment concluded by alleging that only "complex, expensive mechanisms" could be used for slack cancellation in rear seating positions. Ford also suggested in its comments that it would be very complex to develop an automatic means for slack

cancellation. Ford stated that all of its slack cancellation mechanisms are activated by opening the adjacent door. Ford also stated that electric slack cancellation mechanisms would be impracticable for rear-seat lap/shoulder belts.

In response to these comments, NHTSA has reexamined its proposal. That proposal was that slack be automatically cancelled either when the belt is unbuckled *or* when the adjacent door is opened. Although not expressly stated by either GM or Ford, the manufacturers' concern appears to be that there is *no* adjacent door for rear seating positions in many of the vehicles that will be subject to these requirements. The effect of the proposal, then, would be to force manufacturers that chose to install tension-relieving devices in rear-seat lap/shoulder belts for passenger vans, extended cab pickups, and the like, to cancel the slack every time the latchplate is unbuckled, because there is no door adjacent to those seating positions.

The agency did not intend such a result. Instead, the agency's intent was to permit the slack to be cancelled either every time the latchplate was unbuckled or each time the door is opened that is designed to allow the occupant of the seating position in question entry and egress to and from the seat. Thus, if a passenger van has a sliding door on the right side of the vehicle that is designed as the means of entry and egress for all rear seat passengers, slack for rear seat lap/shoulder belts in that van must be cancelled either when that sliding door is opened or when the belt latchplate is unbuckled. Similarly, if a two-door convertible has tension-relieving devices for its rear- seat lap/shoulder belts, slack in the rear-seat lap/shoulder belts must be cancelled either when the latchplate is unbuckled or when the door is opened on the same side of the vehicle as the rear outboard seating position.

This approach will permit manufacturers to use, with appropriate modifications, the same slack cancellation mechanism that is activated by the opening of an adjacent door in seating positions that are not immediately adjacent to the door. The agency is not aware of any reasons why cable routing concerns would present any insuperable difficulties for slack cancellation for the rear- seat lap/shoulder belt systems that are not adjacent to a door. Accordingly, S7.4.2(c) of Standard No. 208 has been amended to provide that slack must be cancelled automatically either when the latchplate is unbuckled or when the door that is designed to provide entry and egress for that seating position is opened.

Both Ford and GM also commented that there was no safety need for automatic cancellation of slack in rear-seat lap/shoulder belts. GM stated that it was not aware of any data showing a safety need for automatic of slack cancellation. Ford commented that there was no possibility of safety belts getting tangled in the door when there was no door adjacent to the seating position at which the tension-relieving device is installed.

NHTSA has previously explained the safety need for automatic slack cancellation in belts equipped with tension-relieving devices. Persons interested in reviewing those discussions may examine 50 CFR 14580; April 12, 1985 and 54 FR 29047; July 11, 1989. Ford and GM did not raise any new arguments that have not already been considered and rejected by the agency. Accordingly, this rule incorporates a requirement for automatic slack cancellation. NHTSA notes that it is currently reviewing a petition that asks the agency to prohibit tension-relieving devices altogether.

8. Relationship of This Rule to Standard No. 210

As noted in the NPRM, section S4.1.1 of Standard No. 210 provides that seat belt anchorages for a Type 2 seat belt assembly (lap/shoulder belt) shall be installed for each forward-facing outboard designated seating position in passenger cars other than convertibles, and for each designated seating position for which a Type 2 seat belt assembly is required by Standard No. 208 in vehicles other than passenger cars. The NPRM proposed to delete Standard No. 210's exemption for convertibles, because the agency was proposing to amend Standard No. 208 to require rear-seat lap/shoulder belts in convertibles. Obviously, there would be lesser benefits from requiring rear-seat lap/shoulder belts in convertibles if those lap/shoulder belts are not required to be effectively anchored to the vehicle. No commenter objected to this proposal, so it is adopted as proposed.

No amendment is needed to ensure that the rear-seat lap/shoulder belts required in other vehicle types covered by this rule will be effectively anchored to the vehicle. As explained above, the existing language of S4.1.1 of Standard No. 210 automatically requires anchorages for lap/shoulder belts to be provided at seating positions required by Standard No. 208 to have lap/shoulder belts.

9. Timing for Applying These New Requirements

Some of the requirements specified in this rule apply to both the vehicle types addressed exclusively in this rule (convertible passenger cars, light trucks, MPVs, and small buses) and to the vehicle type previously addressed in NHTSA's June 14, 1989 final rule (passenger cars other than convertibles). These requirements include the types of retractors that can be installed on rear-seat lap/shoulder belts and special performance requirements for tension-relieving devices installed on rear seat-lap/shoulder belts.

The NPRM proposed that these general requirements, as well as the new requirement that rear-seat

lap/shoulder belts be installed, apply to the vehicle types addressed exclusively in this rule for all such vehicles manufactured on or after September 1, 1991. None of the commenters has provided any evidence demonstrating that the amount of leadtime would be inadequate. Accordingly, the requirements in this rule will apply to convertible passenger cars, light trucks, MPVs and small buses as of September 1, 1991, as was proposed. Earlier compliance is also permitted and encouraged.

With respect to passenger cars, the June 14, 1989 final rule established certain general requirements applicable to cars manufactured on or after September 1, 1990. These general requirements included a requirement that rear-seat lap/shoulder belts be integral and that the upper anchorage for the rear-seat lap/shoulder belt comply with the location requirements of Standard No. 210. The general requirements of this rule for rear-seat lap/shoulder belts (retractor type and special requirements for tension-relieving devices) will apply on or after September 1, 1991, the same data as the other requirements mandated by this rule take effect. The general requirements of this rule will require greater changes, and thus longer leadtime, than the general requirements announced in the June 14, 1989 rule. Accordingly, passenger cars manufactured on or after September 1, 1991 must comply with the retractor type and tension-relieving device requirements set forth in this rule.

In consideration of the foregoing, 49 CFR Part 571.208 is amended as follows:

S4.1.4 of Standard No. 208 is revised to read as follows:

S4.1.4 *Passenger cars manufactured on or after September 1, 1989.*

S4.1.4.1 Except as provided in S4.1.4.2, each passenger car manufactured on or after September 1, 1989 shall comply with the requirements of S4.1.2.1. Any passenger car manufactured on or after September 1, 1989 and before September 1, 1993 whose driver's designated seating position complies with the requirements of S4.1.2.1(a) by means not including any type of seat belt and whose right front designated seating position is equipped with a manual Type 2 seat belt so that the seating position complies with the occupant crash protection requirements of S5.1, with the Type 2 seat belt assembly adjusted in accordance with S7.4.2, shall be counted as a vehicle complying with S4.1.2.1. A vehicle shall not be deemed to be in noncompliance with this standard if its manufacturer establishes that it did not know in the exercise of due care that such vehicle is not in conformity with this standard.

S4.1.4.2 (a) Each passenger car, other than a convertible, manufactured before December 11, 1989 may be equipped with, and each passenger car, other than a convertible, manufactured on or after December 11, 1989 and before September 1, 1990 shall be equipped with a Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed pursuant to this provision shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1.1 of this standard.

(b) Except as provided in S4.1.4.2.1, each passenger car other than a convertible manufactured on or after September 1, 1990 and each convertible passenger car manufactured on or after September 1, 1991 shall be equipped with an integral Type 2 seat belt assembly at every forward-facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.2 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.1.4.2.1 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.1.4.2 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.1.4.2.2 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requirements of S4.1.4.2, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

3. A new S4.2.4 is added to Standard No. 208, to read as follows:

S4.2.4 *Trucks and multipurpose passenger vehicles manufactured on or after September 1, 1991 with a GVWR of 10,000 pounds or less.*. Except as provided in S4.2.4.2, each truck and each multipurpose passenger vehicle, except a motor home, manufactured on or after September 1, 1991 that has a gross vehicle weight rating of 10,000 pounds or less shall be equipped with an integral Type 2 seat belt assembly at every forward-

facing rear outboard designated seating position. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.2.4.1 As used in this section —

(a) "Motor home" means a motor vehicle with motive power that is designed to provide temporary residential accommodations, as evidenced by the presence of at least four of the following facilities: cooking; refrigeration or ice box; self-contained toilet; heating and/or air conditioning; a portable water supply system including a faucet and a sink; and a separate 110-125 volt electrical power supply and/or an LP gas supply.

(b) "Rear outboard designated seating position" means any "outboard designated seating position" (as that term is defined at 49 CFR 571.3) that is rearward of the front seat(s), except any designated seating positions adjacent to a walkway located between the seat and the side of the vehicle, which walkway is designed to allow access to more rearward seating positions.

S4.2.4.2 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.2.4 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.2.4.3 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requrements of S4.2.4, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

4. A new S4.4.3 is added to Standard No. 208, to read as follows:

S4.4 *Buses.*

*   *   *   *   *

S4.4.3 Buses manufactured on or after September 1, 1991.

S4.4.3.1 Each bus with a gross vehicle weight rating of more than 10,000 pounds shall comply with the requirements S4.4.2.1 or S4.4.2.2.

S4.4.3.2 Except as provided in S4.4.3.2.2, each bus with a gross vehicle weight rating of 10,000 pounds or less, except a school bus, shall be equipped with an integral Type 2 seat belt assembly at the driver's designated seating position and at the front and every rear forward-facing outboard designated seating position, and with a Type 1 or Type 2 seat belt assembly at all other designated seating positions. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

S4.4.3.2.1 As used in this section, a "rear outboard designated position" means any "outboard designated seating position" (as that term is defined at 49 CFR 571.3) that is rearward of the front seat(s), except any designated seating positions adjacent to a walkway located between the seat and the side of the vehicle, which walkway is designed to allow access to more rearward seating positions.

S4.4.3.2.2 Any rear outboard designated seating position with a seat that can be adjusted to be forward-facing and to face some other direction shall either:

(i) meet the requirements of S4.4.3.2 with the seat in any position in which it can be occupied while the vehicle is in motion; or

(ii) when the seat is in its forward-facing position, have a Type 2 seat belt assembly with an upper torso restraint that conforms to S7.1 and S7.2 of this standard and that adjusts by means of an emergency locking retractor that conforms with Standard No. 209 (49 CFR 571.209), which upper torso restraint may be detachable at the buckle, and, when the seat is in any position in which it can be occupied while the vehicle is in motion, have a Type 1 seat belt or the pelvic portion of a Type 2 seat belt assembly that conforms to S7.1 and S7.2 of this standard.

S4.4.3.2.3 Any rear outboard designated seating position with a readily removable seat (that is, a seat designed to be easily removed and replaced by means installed by the manufacturer for that purpose) shall meet the requirements of S4.4.3.2, and may use an upper torso belt that detaches at the upper anchorage point to meet those requirements.

S4.4.3.3 Each school bus with a gross vehicle weight rating of 10,000 pounds or less shall be equipped with an integral Type 2 seat belt assembly at the driver's designated seating position and at the right front passenger's designated seating position (if any), and with a Type 1 or Type 2 seat belt assembly at all other designated seating positions. Type 2 seat belt assemblies installed in compliance with this requirement shall comply with Standard No. 209 (49 CFR 571.209) and with S7.1 and S7.2 of this standard. The lap belt portion of a Type 2 seat belt assembly installed at the driver's designated seating position and at the right front passenger's designated seating position (if any) shall include either an emergency locking retractor or an automatic locking retractor, which retractor shall not retract webbing to the next locking position until at least 3/4 inch of webbing has moved into the retractor. In determining whether an automatic locking retractor complies with this requirement, the webbing is extended to 75 percent of its length and the retractor is locked after the initial adjustment. If a Type 2 seat belt assembly installed in compliance with this requirement incorporates any webbing tension-relieving device, the vehicle owner's manual shall include the information specified in S7.4.2(b) of this standard for the tension-relieving device, and the vehicle shall comply with S7.4.2(c) of this standard.

5. S7.1.1 of Standard No. 208 is amended by revising S7.1.1.3 and by adding a new S7.1.1.5, to read as follows:

S7.1 *Adjustment.*

* * * * *

S7.1.1.3 A Type 1 lap belt or the lap belt portion of any Type 2 seat belt assembly installed at any outboard designated seating position of a vehicle with a gross vehicle weight rating of 10,000 pounds or less to comply with a requirement of ths standard, except walk-in van-type vehicles and school buses, shall meet the requirements of S7.1 by means of any emergency locking retractor that conforms to Standard No. 209 (49 CFR 571.209).

* * * * *

S7.1.1.5 Seat belt assemblies installed at a seating position other than the driver's position that incorporate an emergency locking retractor in the lap belt or the lap belt portion of a Type 2 seat belt assembly shall provide some means other than an external device that requires manual attachment or activation to lock the lap belt or lap belt portion, by preventing additional webbing from spooling out, so that the seat belt assembly can be used to tightly secure a child restraint system.

6. S7.4.2 of Standard No. 208 is amended by revising the introductory text and S7.4.2(c), to read as follows:

S7.4.2 *Webbing tension-relieving device.* Each vehicle with an automatic seat belt assembly or with a Type 2 manual seat belt assembly that must meet the occupant crash protection requirements of S5.1 of this standard installed at a front outboard designated seating position, and each vehicle with a Type 2 manual seat belt assembly installed at a rear outboard designated seating position in compliance with a requirement of this standard, that has either automatic or manual tension-relieving devices permitting the introduction of slack in the webbing of the shoulder belt (e.g., "comfort clips" or "window-shade" devices) shall:

* * * * *

(c) Have, except for open-body vehicles with no doors, and automatic means to cancel any shoulder belt slack introduced into the belt system by a tension-relieving device. In the case of an automatic safety belt system, cancellation of the tension-relieving device shall occur each time the adjacent vehicle door is opened. In the case of a manual seat belt required to meet S5.1, cancellation of the tension-relieving device shall occur, at the manufacturer's option, either each time the adjacent door is opened or each time the latchplate is released from the buckle. In the case of a Type 2 manual seat belt assembly installed at a rear outboard designated seating position, cancellation of the tension-relieving device shall occur, at the manufacturer's option either each time the door designed to to allow the occupant of that seating position entry and egress of the vehicle is opened or each time the latchplate is released from the buckle. In the case of open-body vehicles with no doors, cancellation of the tension-relieving device may be done by a manual means.

§571.210 [Amended]

7. S4.1.1 of Standard No. 210 is revised to read as follows:

S4.1.1 Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each forward-facing outboard designated seating position in passenger cars other than convertibles and for each designated seating position for which a Type 2 seat belt assembly is required by Standard No. 208 (49 CFR 571.208) in vehicles other than passenger cars. Seat belt anchorages for a Type 2 seat belt assembly shall be installed for each rear forward-facing outboard designated seating position in convertible passenger cars manufactured on or after September 1, 1991.

§571.222 [Amended]

8. S5(b) of Standard No. 222 is revised to read as follows:

S5. Requirements. (a) * * *

(b) Each vehicle with a gross vehicle weight rating of 10,000 pounds or less shall be capable of meeting the following requirements at all seating positions other than the driver's seat:

(1)(A) In the case of vehicles manufactured before September 1, 1991, the requirements of §§571.208,

571.209, and 571.210 as they apply to multipurpose passenger vehicles; or

(B) In the case of vehicles manufactured on or after September 1, 1991, the requirements of S4.4.3.3. of §571.208 and the requirements of §§571.209 and 571.210 as they apply to school buses with a gross vehicle weight rating of 10,000 pounds or less; and

(2) The requirements of S5.1.2, S5.1.3, S5.1.4, S5.1.5, and S5.3 of this standard. However, the requirements of §§571.208 and 571.210 shall be met at W seating positions in a bench seat using a body block as specified in Figure 2 of this standard, and a particular school bus passenger seat (i.e., a test specimen) in that weight class need not meet further requirements after having met S5.1.2 and S5.1.5, or after having been subjected to either S5.1.3, S5.1.4, or S5.3 of this standard or §571.210.

* * * * *

Issued on: October 27, 1989.

Jeffrey R. Miller
Acting Administrator

54 F.R. 46257
November 2, 1989

MOTOR VEHICLE SAFETY STANDARD NO. 222

School Bus Seating and Crash Protection

S1. Scope. This standard establishes occupant protection requirements for school bus passenger seating and restraining barriers.

S2. Purpose. The purpose of this standard is to reduce the number of deaths and the severity of injuries that result from the impact of school bus occupants against structures within the vehicle during crashes and sudden driving maneuvers.

S3. Application. This standard applies to school buses.

S4. Definitions. "Contactable surface" means any surface within the zone specified in S5.3.1.1 that is contactable from any direction by the test device described in S6.6, except any surface on the front of a seat back or restraining barrier 3 inches or more below the top of the seat back or restraining barrier.

"School bus passenger seat" means a seat in a school bus, other than the driver's seat or a seat installed to accommodate handicapped or convalescent passengers as evidenced by orientation of the seat in a direction that is more than 45 degrees to the left or right of the longitudinal centerline of the vehicle.

S4.1 The number of seating positions considered to be in a bench seat is expressed by the symbol W, and calculated as the bench width in inches divided by 15 and rounded to the nearest whole number.

S5. Requirements. (a) Each vehicle with a gross vehicle weight rating of more than 10,000 pounds shall be capable of meeting any of the requirements set forth under this heading when tested under the conditions of S6. However, a particular school bus passenger seat (i.e., test specimen) in that weight class need not meet further requirements after having met S5.1.2 and S5.1.5, or having been subjected to either S5.1.3, S5.1.4, or S5.3.

(b) [Each vehicle with a gross vehicle weight rating of 10,000 pounds or less shall be capable of meeting the following requirements at all seating positions other than the driver's seat:

(1)(A) In the case of vehicles manufactured before September 1, 1991, the requirements of §§ 571.208, 571.209, and 571.210 as they apply to multipurpose passenger vehicles; or

(B) In the case of vehicles manufactured on or after September 1, 1991, the requirements of S4.4.3.3 of § 571.208 and the requirements of §§ 571.209 and 571.210 as they apply to school buses with a gross vehicle weight rating of 10,000 pounds or less; and

(2) The requirements of S5.1.2, S5.1.3, S5.1.4, S5.1.5, and S5.3 of this standard. However, the requirements of §§ 571.208, and 571.210 shall be met at W seating positions in a bench seat using a body block as specified in Figure 2 of this standard, and a particular school bus passenger seat (i.e., a test specimen) in that weight class need not meet further requirements after having met S5.1.2 and S5.1.5, or after having been subjected to either S5.1.3, S5.1.4, or S5.3 of this standard of § 571.210. **54 F.R. 46257—November 2, 1989. Effective: May 1, 1990)]**

S5.1 Seating requirements. School bus passenger seats shall be forward facing.

S5.1.1 [Reserved]

S5.1.2 Seat back height and surface area. Each school bus passenger seat shall be equipped with a seat back that, in the front projected view, has a front surface area above the horizontal plane that passes through the seating reference point, and below the horizontal plane 20 inches above the seating reference point, of not less than 90 percent of the seat bench width in inches multiplied by 20.

S5.1.3 Seat performance forward. When a school bus passenger seat that has another seat

behind it is subjected to the application of force as specified in S5.1.3.1 and S5.1.3.2, and subsequently, the application of additional force to the seat back as specified in S5.1.3.3 and S5.1.3.4:

(a) The seat-back force/deflection curve shall fall within the zone specified in Figure 1;

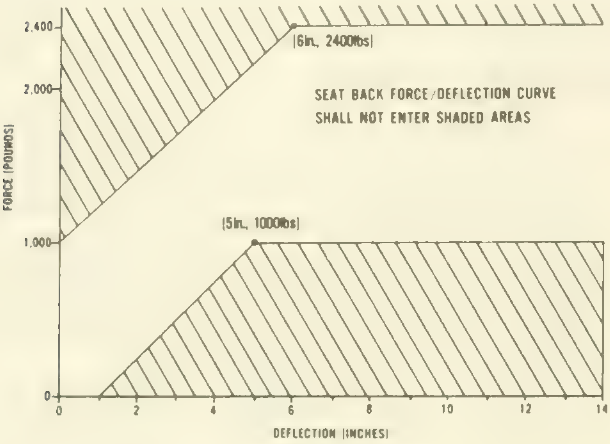


FIGURE 1 - FORCE/DEFLECTION ZONE

(b) Seat back deflection shall not exceed 14 inches; (for determination of (a) and (b) the force/deflection curve describes only the force applied through the upper loading bar, and only the forward travel of the pivot attachment point of the upper loading bar, measured from the point at which the initial application of 10 pounds of force is attained.)

(c) The seat shall not deflect by an amount such that any part of the seat moves to within 4 inches of any part of another school bus passenger seat or restraining barrier in its originally installed psition;

(d) The seat shall not separate from the vehicle at any attachment point; and

(d) Seat components shall not separate at any attachment point.

S5.1.3.1 Position the loading bar specified in S6.5 so that it is laterally centered behind the seat back with the bar's longitudinal axis in a transverse plane of the vehicle and in any horizontal plane between 4 inches above and 4 inches below the seating reference point of the school bus passenger seat behind the test specimen.

S5.1.3.2 Apply a force of 700W pounds horizontally in the forward direction through the loading bar at the pivot attachment point. Reach the specified load in not less than 5 nor more than 30 seconds.

S5.1.3.3 No sooner than 1.0 second after attaining the required force, reduce that force to 350W pounds and, while maintaining the pivot point position of the first loading bar at the position where the 350W pounds is attained, position a second loading bar described in S6.5 so that it is laterally centered behind the seat back with the bar's longitudinal axis in a transverse plane of the vehicle and in the horizontal plane 16 inches above the seating reference point of the school bus passenger seat behind the test specimen, and move the bar forward against the seat back until a force of 10 pounds has been applied.

S5.1.3.4 Apply additional force horizontally in the forward direction through the upper bar until 4,000W inch-pounds of energy have been absorbed in deflecting the seat back (or restraining barrier). Apply the additional load in not less than 5 seconds nor more than 30 seconds. Maintain the pivot attachment point in the maximum forward travel position for not less than 5 seconds nor more than 10 seconds and release the load in not less than 5 nor more than 30 seconds. (For the determination of S5.1.3.4 the force/deflection curve describes only the force applied through the upper loading bar, and the forward and rearward travel distance of the upper loading bar pivot attachment point measured from the position at which the initial application of 10 pounds of force is attained.)

S5.1.4 Seat performance rearward. When a school bus passenger seat that has another seat behind it is subjected to the application of force as specified in S5.1.4.1 and S5.1.4.2:

(a) Seat back force shall not exceed 2,200 pounds;

(b) In the case of a school bus manufactured on or after April 1, 1978, seat back deflection shall not exceed 10 inches; (For determination of (a) and (b) the force/deflection curve describes only the force applied through the loading bar, and only the rearward travel of the pivot attachment point of the loading bar, measured from the point at which the initial application of 50 pounds of force is attained.

(c) The seat shall not deflect by an amount such that any part of the seat moves to within 4 inches of any part of another passenger seat in its originally installed position;

(d) The seat shall not separate from the vehicle at any attachment point; and

(e) Seat components shall not separate at any attachment point.

S5.1.4.1 Position the loading bar described in S6.5 so that it is laterally centered forward of the seat back with the bar's longitudinal axis in a transverse plane of the vehicle and in the horizontal plane 13.5 inches above the seating reference point of the test specimen, and move the loading bar rearward against the seat back until a force of 50 pounds has been applied.

S5.1.4.2 Apply additional force horizontally rearward through the loading bar until 2,800W inch-pounds of energy have been absorbed in deflecting the seat back. Apply the additional load in not less than 5 seconds nor more than 30 seconds. Maintain the pivot attachment point in the maximum rearward travel position for not less than 5 seconds nor more than 10 seconds and release the load in not less than 5 seconds nor more than 30 seconds. (For determination of S5.1.4.2 the force/deflection curve describes the force applied through the loading bar and the rearward and forward travel distance of the loading bar pivot attachment point measured from the position at which the initial application of 50 pounds of force is attained.)

S5.1.5 Seat cushion retention. In the case of school bus passenger seats equipped with seat cushions, with all manual attachment devices between the seat and the seat cushion in the manufacturer's designed position for attachment, the seat cushion shall not separate from the seat at any attachment point when subjected to an upward force of five times the seat cushion weight, applied in any period of not less than 1 nor more than 5 seconds, and maintained for 5 seconds.

S5.2 Restraining barrier requirements. Each vehicle shall be equipped with a restraining barrier forward of any designated seating position that does not have the rear surface of another school bus passenger seat within 20 inches of its seating reference point, measured along a horizontal longitudinal line through the seating reference point in the forward direction.

S5.2.1 Barrier-seat separation. The horizontal distance between the restraining barrier's rear surface and the seating reference point of the seat in front of which it is required shall be not more than 20 inches, measured along a horizontal longitudinal line through the seating reference point in the forward direction.

S5.2.2 Barrier position and rear surface area. The position and rear surface area of the restraining barrier shall be such that, in a front projected view of the bus, each point of the barrier's perimeter coincides with or lies outside of the perimeter of the seat back of the seat for which it is required.

S5.2.3 Barrier performance forward. When force is applied to the restraining barrier in the same manner as specified in S5.1.3.1 through S5.1.3.4 for seating performance tests:

(a) The restraining barrier force/deflection curve shall fall within the zone specified in Figure 1;

(b) Restraining barrier deflection shall not exceed 14 inches; (For computation of (a) and (b) the force/deflection curve describes only the force applied through the upper loading bar, and only the forward travel of the pivot attachment point of the loading bar, measured from the point at which the initial application of 10 pounds of force is attained.)

(c) Restraining barrier deflection shall not interfere with normal door operation;

(d) The restraining barrier shall not separate from the vehicle at any attachment point; and

(e) Restraining barrier components shall not separate at any attachment point.

S5.3 Impact zone requirements.

S5.3.1 Head protection zone. Any contactable surface of the vehicle within any zone specified in S5.3.1.1 shall meet the requirements of S5.3.1.2 and S5.3.1.3. However, a surface area that has been contacted pursuant to an impact test need not meet further requirements contained in S5.3.

S5.3.1.1 The head protection zones in each vehicle are the spaces in front of each school bus passenger seat which are not occupied by bus sidewall, window, or door structure and which, in relation to that seat and its seating reference point, are enclosed by the following planes;

(a) Horizontal planes 12 inches and 40 inches above the seating reference point;

(b) A vertical longitudinal plane tangent to the inboard (aisle side) edge of the seat;

(c) A vertical longitudinal plane 3.25 inches inboard of the outboard edge of the seat, and

(d) Vertical transverse planes through and 30 inches forward of the reference point.

S5.3.1.2 Head form impact requirement. When any contactable surface of the vehicle within the zones specified in S5.3.1.1 is impacted from any direction at 22 feet per second by the head form described in S6.6, the axial acceleration at the center of gravity of the head form shall be such that the expression

$$\left[\frac{1}{(t_2 - t_1)}\int_{t_1}^{t_2} a\,dt\right]^{2.5}(t_2 - t_1)$$

shall not exceed 1,000 where a is the axial acceleration expressed as a multiple of g (the acceleration due to gravity), and t_1 and t_2 are any two points in time during the impact.

S5.3.1.3 Head form force distribution. When any contactable surface of the vehicle within the zones specified in S5.3.1.1 is impacted from any direction at 22 feet per second by the head form

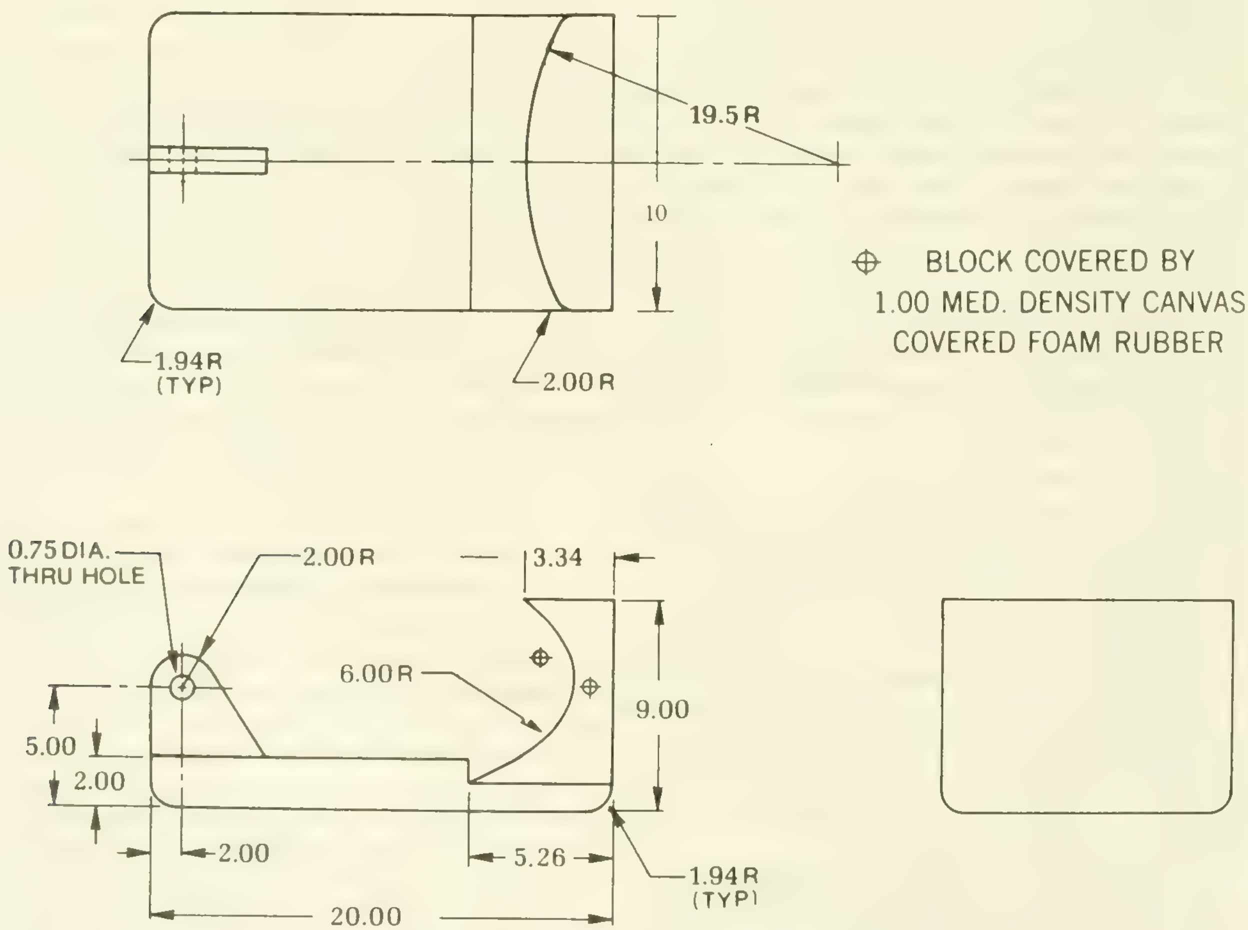


FIGURE 2—BODY BLOCK FOR LAP BELT

described in S6.6, the energy necessary to deflect the impacted material shall be not less than 40 inch-pounds before the force level on the head form exceeds 150 pounds. When any contactable surface within such zones is impacted by the head form from any direction at 5 feet per second, the contact area on the head form surface shall be not less than 3 square inches.

S5.3.2 Leg protection zone. Any part of the seat backs or restraining barriers in the vehicle within any zone specified in S5.3.2.1 shall meet the requirements of S5.3.2.2.

S5.3.2.1. The leg protection zones of each vehicle are those parts of the school bus passenger seat backs and restraining barriers bounded by horizontal planes 12 inches above and 4 inches below the seating reference point of the school bus passenger seat immediately behind the seat back or restraining barrier.

S5.3.2.2. When any point on the rear surface of that part of a seat back or restraining barrier within any zone specified in S5.3.2.1 is impacted from any direction at 16 feet per second by the knee form specified in S6.7, the resisting force of the impacted material shall not exceed 600 pounds and the contact area on the knee form surface shall not be less than 3 square inches.

S6. Test conditions. The following conditions apply to the requirements specified in S5.

S6.1 Test surface. The bus is at rest on a level surface.

S6.2 Tires. Tires are inflated to the pressure specified by the manufacturer for the gross vehicle weight rating.

6.3 Temperature. The ambient temperature is any level between 32 degrees F. and 90 degrees F.

S6.4 Seat back position. If adjustable, a seat back is adjusted to its most upright position.

S6.5 Loading bar. The loading bar is a rigid cylinder with an outside diameter of 6 inches that has hemispherical ends with radii of 3 inches and with a surface roughness that does not exceed 63 micro-inches, root mean square. Then length of the loading bar is 4 inches less than the width of the seat back in each test. The stroking mechanism applies force through a pivot attachment at the centerpoint of the loading bar which allows the loading bar to rotate in a horizontal plane 30 degrees in either direction from the transverse position.

S6.5.1 A vertical or lateral force of 4,000 pounds applied externally through the pivot attachment point of the loading bar at any position reached during a test specified in this standard shall not deflect that point more than 1 inch.

S6.6 Head form. The head form for the measurement of acceleration is a rigid surface comprised of two hemispherical shapes, with total equivalent weight of 11.5 pounds. The first of the two hemispherical shapes has a diameter of 6.5 inches. The second of the two hemispherical shapes has a 2 inch diameter and is centered as shown in Figure 3 to protrude from the outer surface of the first hemispherical shape. The surface roughness of the hemispherical shapes does not exceed 63 micro-inches, root mean square.

S6.6.1 The direction of travel of the head form is coincidental with the straight line connecting the centerpoints of the two spherical outer surfaces which constitute the head form shape.

S6.6.2 The head form is instrumented with an acceleration sensing device whose output is recorded in a data channel that conforms to the requirements for a 1,000 Hz channel class as specified in SAE Recommended Practice J211a, December 1971. The head form exhibits no resonant frequency below three times the frequency of the channel class. The axis of the acceleration sensing device coincides with the straight line connecting the centerpoints of the two hemispherical outer surfaces which constitute the head form shape.

S6.6.3 The head form is guided by a stroking device so that the direction of travel of the head form is not affected by impact with the surface being tested at the levels called for in the standard.

BIHEMISPHERICAL HEAD FORM RADII

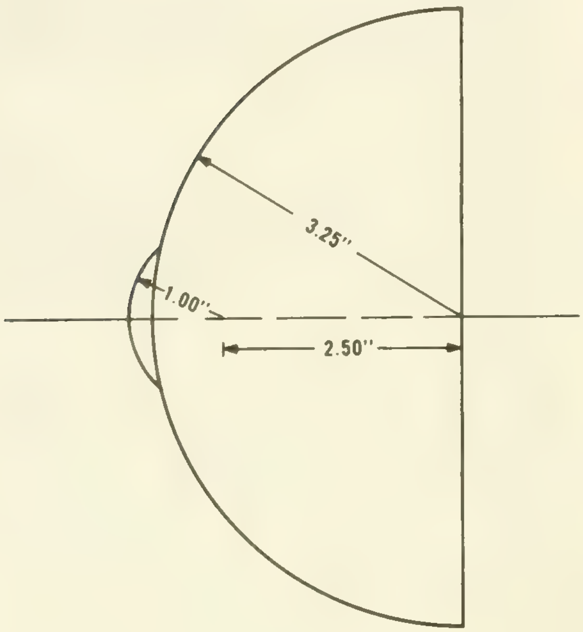


FIGURE 3

S6.7 Knee form. The knee form for measurement of force is a rigid 3-inch-diameter cylinder, with an equivalent weight of 10 pounds, that has one rigid hemispherical end with a 1½ inch radius forming the contact surface of the knee form. The hemispherical surface roughness does not exceed 63 micro-inches, root mean square.

S6.7.1 The direction of travel of the knee form is coincidental with the centerline of the rigid cylinder.

S6.7.2 The knee form is instrumented with an acceleration sensing device whose output is recorded in a data channel that conforms to the requirements of a 600 Hz channel class as specified in the SAE Recommended Practice J211a, December 1971. The knee form exhibits no resonant frequency below three times the frequency of the channel class. The axis of the acceleration sensing device is aligned to measure acceleration along the centerline of the cylindrical knee form.

S6.7.3 The knee form is guided by a stroking device so that the direction of travel of the knee form is not affected by impact with the surface being tested at the levels called for in the standard.

S6.8 The head form, knee form, and contactable surfaces are clean and dry during impact testing.

41 F.R. 4016
January 28, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301

Fuel System Integrity

(Docket No. 70-20; Notice 2)

This notice amends Motor Vehicle Safety Standard No. 301 on fuel system integrity to specify static rollover requirements applicable to passenger cars on September 1, 1975, and to extend applicability of the standard to multipurpose passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less on September 1, 1976.

The NHTSA proposed amending 49 CFR 571.301, *Fuel Tanks, Fuel Tank Filler Pipes, and Fuel Tank Connections*, on August 29, 1970, (35 F.R. 13799). Under the proposal the standard would be extended to all vehicles with a GVWR of 10,000 pounds or less. No fuel spillage would be permitted during the standard's tests. As proposed, these would include a spike stop from 60 mph, and a 30 mph frontal barrier crash. Additional tests for vehicles with a GVWR of 6,000 pounds or less would include a rear-end collision with a fixed barrier at 30 mph, and a static rollover test following the frontal barrier crash. With respect to the proposal: the frontal impact and static rollover tests are adopted but with an allowance of fuel spillage of 1 ounce per minute; the spike stop test is not adopted; and the rear-end fixed barrier collision test is being reproposed in a separate rule making action published today to substitute a moving barrier.

The proposal that there be zero fuel spillage was almost universally opposed for cost/benefit reasons. The NHTSA has concluded that the requirement adopted, limiting fuel spillage to 1 ounce per minute, will have much the san effect as a zero-loss requirement. The standa will effectively require motor vehicles to be c signed for complete fuel containment, since any spillage allowed by design in the aftermath of testing could well exceed the limit of the standard. At the same time, the 1-ounce allowance would eliminate concern over a few drops of spillage that in a functioning system may be unavoidable.

Fuel loss will be measured for a 15-minute period for both impact and rollover tests.

The NHTSA proposed a panic-braking stop from 60 mph to demonstrate fuel system integrity. Many commented that this appeared superfluous, increasing testing costs with no performance improvements, since the proposed front and rear impact tests represented considerably higher deceleration loadings than could be achieved in braking. The NHTSA concurs, and has not adopted the panic stop test. The frontal barrier crash at 30 mph has been retained for passenger cars, and extended to multipurpose passenger vehicles, trucks, and buses with a GVWR of 10,000 pounds or less as of September 1, 1976.

The static rollover test was adopted as proposed. It applies to passenger cars as of September 1, 1975, and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 6,000 pounds or less, as of September 1, 1976. The rollover test follows the front barrier crash, and consists of a vehicle being rotated on its longitudinal axis at successive increments of 90°. A condition of the test is that rotation between increments occurs in not less than 1 minute and not more than 3 minutes. After reaching a 90° increment, the vehicle is held in that position for 5 minutes.

The proposed rear-end crash test incorporated a fixed collision barrier. Manufacturers generally favored a moving barrier impact as a closer

simulation of real world conditions. The NHTSA concurs and is not adopting a rear end fixed barrier test. Instead, it is proposing a rear-end moving barrier collision test as part of the notice of proposed rulemaking published today.

Under the proposal the vehicle would be loaded to its GVWR with the fuel tank filled to any level between 90 and 100 percent of capacity. Many commenters objected on the grounds that full loading of a vehicle represents an unrealistic condition in terms of actual crash experience. The NHTSA does not agree. Although full loading of a vehicle is not the condition most frequently encountered, it certainly occurs frequently enough that the vehicle should be designed to give basic protection in that condition. The vehicle test weight condition has been adopted as proposed. It should be noted that, in the parallel notice of proposed rulemaking issued today, vehicles would be tested under the weight conditions specified in Standard No. 208, effective September 1, 1975.

In consideration of the foregoing, 49 CFR Part 571.301, Motor Vehicle Safety Standard No. 301, is amended . . . .

Effective date: September 1, 1975. Because of the necessity to allow manufacturers sufficient production leadtime it is found for good cause shown that an effective date later than 1 year after issuance of this rule is in the public interest.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718, 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.51.)

Issued on August 15, 1973.

James B. Gregory
Administrator

38 F.R. 22397
August 20, 1973

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301

Fuel System Integrity

(Docket No. 73-20; Notice 2)

The purpose of this notice is to amend Federal Motor Vehicle Safety Standard No. 301, *Fuel System Integrity*, to upgrade substantially the requirements of the standard by specifying a rear moving barrier crash, a lateral moving barrier crash, and a frontal barrier crash including impacts at any angle up to 30° in either direction from the perpendicular.

A notice of proposed rulemaking published August 20, 1973 (38 F.R. 22417) proposed the imposition of additional testing requirements designed to ameliorate the dangers associated with fuel spillage following motor vehicle accidents. In an amendment to Standard No. 301, published on the same day as the proposal, a frontal barrier crash and a static rollover test were specified. In order to ensure the safety of fuel systems in any possible collision situation, the NHTSA finds it essential to incorporate additional proposed test requirements into the present standard and to make these requirements applicable to all vehicle types with a GVWR of 10,000 pounds or less.

Comments in response to the proposal were received from 29 commenters. Any suggestions for changes of the proposal not specifically mentioned herein are denied, on the basis of all the information presently available to this agency. A number of the issues raised in the comments have been dealt with by the agency in its response to the petitions for reconsideration of the final rule issued on August 20, 1973. In its notice responding to the petitions, the NHTSA considered objections to the use of actual fuel during testing, the specified fuel fill level, the application of the standard to vehicles using diesel fuel, the fuel spillage measuring requirement, and the allegedly more stringent loading requirements applicable to passenger cars. The type of fuel subject to the standard was also clarified.

Objections were registered by 13 commenters to the proposed inclusion of a dynamic rollover test in the fuel system integrity standard. As proposed, the requirement calls for a measurement of the fuel loss while the vehicle is in motion. Commenters pointed out the exceptional difficulty in measuring or even ascertaining a leakage when the vehicle is rolling over at 30 mph. The NHTSA has decided that the objections have merit, and has deleted the dynamic rollover test. The results of the dynamic rollover do not provide sufficiently unique data with regard to the fuel system's integrity to justify the cost of developing techniques for accurately measuring spillage during such a test, and of conducting the test itself. The NHTSA has concluded that the severity of the other required tests, when conducted in the specified sequence, is sufficient to assure the level of fuel system integrity intended by the agency.

Triumph Motors objected to the use of a 4,000-pound barrier during the moving barrier impacts, asserting that such large barriers discriminate against small vehicles. Triumph requested that the weight of the barrier be the curb weight of the vehicle being tested in order to alleviate the burden on small vehicles. The NHTSA has concluded that no justification exists for this change. The moving barrier is intended to represent another vehicle with which the test vehicle must collide. The use of a 4,000-pound moving barrier is entirely reasonable since vehicles in use are often over 4,000 pounds in weight and a small vehicle is as likely to collide with a vehicle of that size as one smaller. The NHTSA considers it important that vehicle fuel systems be

designed in such a way as to withstand impacts from vehicles they are exposed to on the road, regardless of the differences in their sizes.

Jeep and American Motors objected to the effective dates of the proposed requirements and asked that they be extended. Jeep favors an effective date not earlier than September 1, 1979, and American Motors favors a September 1, 1978, effective date. The NHTSA denies these requests. It has found that the time period provided for development of conforming fuel systems is reasonable and should be strictly adhered to considering the urgent need for strong and resilient fuel systems.

Several commenters expressed concern over the impact of the prescribed testing procedures on manufacturers of low-volume specialty vehicles. The NHTSA appreciates the expense of conducting crash tests on low-production vehicles, realizing that the burden on the manufacturer is related to the number of vehicles he manufactures. However, there are means by which the small-volume manufacturer can minimize the costs of testing. He can concentrate test efforts on the vehicle(s) in his line that he finds most difficult to produce in conformity with the standard. These manufacturers should also be aware that an exemption from application of the standard is available where fewer than 10,000 vehicles per year are produced and compliance would subject him to substantial financial hardship.

In responding to the petitions for reconsideration of the amendment to Standard No. 301, published August 20, 1973, the NHTSA revised the fuel system loading requirement to specify Stoddard solvent as the fuel to be used during testing. In accordance with that amendment, the proposed requirement that the engine be idling during the testing sequence is deleted. However, electrically driven fuel pumps that normally run when the electrical system in the vehicle is activated shall be operating during the barrier crash tests.

In order to fulfill the intention expressed in the preamble to the proposal, that simultaneous testing under Standards Nos. 208 and 301 be possible, language has been added to subparagraph S7.1.5 of Standard No. 301 specifying the same method of restraint as that required in Standard No. 208. In its response to petitions for reconsideration of Standard No. 301 (39 F.R. 10586) the NHTSA amended the standard by requiring that each dummy be restrained during testing only by means that are installed in the vehicle for protection at its seating position and that require no action by the vehicle occupant.

Suggestions by several commenters that the application of certain crash tests should be limited to passenger cars in order to maintain complete conformance to the requirements of Standard No. 208 are found to be without merit. Enabling simultaneous testing under several standards, although desirable, is not the most important objective of the safety standards. The NHTSA is aware of the burden of testing costs, and therefore has sought to ease that burden where possible by structuring certain of its standards to allow concurrent testing for compliance. It must be emphasized, however, that the testing requirements specified in a standard are geared toward a particular safety need. Application of the tests proposed for Standard No. 301 to all vehicle types with a GVWR of 10,000 pounds or less is vital to the accomplishment of the degree of fuel system integrity necessary to protect the occupants of vehicles involved in accidents.

No major objections were raised concerning the proposed angular frontal barrier crash, lateral barrier crash, or rear moving barrier crash. On the basis of all information available to this agency, it has been determined that these proposed crash tests should be adopted as proposed.

In consideration of the foregoing, 49 CFR 571.301, Motor Vehicle Safety Standard No. 301, is amended to read as set forth below.

Effective date: September 1, 1975, with additional requirements effective September 1, 1976, and September 1, 1977, as indicated.

(Secs. 103, 119, Pub. L. 89-563, 80 Stat. 718, 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.51.)

Issued on March 18, 1974.

James B. Gregory
Administrator

39 F.R. 10588
March 21, 1974

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301-75

Fuel System Integrity

(Docket No. 73-20; Notice 3)

This notice responds to petitions for reconsideration of the two recent Federal Register notices amending and upgrading Standard No. 301 (39 F.R. 10586; 39 F.R. 10588) and amends the standard in several respects.

On March 21, 1974 two notices were published pertaining to Standard No. 301, *Fuel System Integrity.* One notice (39 F.R. 10586) responded to petitions for reconsideration of an earlier amendment to the standard (38 F.R. 22397), while the other (39 F.R. 10588) substantially upgraded the standard's performance requirements. It was the intention of the NHTSA that the notice upgrading the standard be considered as the final rule and supersede the notice responding to petitions. Hereafter, the notice responding to petitions will be referred to as Notice 1, while the notice upgrading the standard will be referred to as Notice 2.

On October 27, 1974, the Motor Vehicle and Schoolbus Safety Amendments of 1974 (P.L. 93-492) were signed into law. These amendments to the National Traffic and Motor Vehicle Safety Act incorporate Standard No. 301 as it was published in Notice 2 on March 21, 1974. According to the amendment the technical errors which appeared in Notice 2 may be corrected, while future amendments are prohibited from diminishing the level of motor vehicle safety which was established in the notice. The changes contained in this notice conform to these statutory requirements.

Due to an oversight, Notice 2 failed to include two provisions which appeared in Notice 1. The limitation of the standard's application to vehicles which use fuel with a boiling point above 32°F was inadvertently omitted in Notice 2 and is hereby reinstated. Notice 2 also failed to include a provision specifying that vehicles not be altered during the testing sequences. It was the intent of the NHTSA that damage or other alteration of the vehicle incurred during the barrier crashes not be corrected prior to the static rollover tests. The test requirements are therefore amended to prohibit the alteration of vehicles following each of the specified test impacts.

In order to clarify the manner in which the load is to be distributed during testing of multipurpose passenger vehicles, trucks, and buses, S7.1.5(b) is amended to require that when the weight on one of the axles exceeds its proportional share of the loaded vehicle weight, when the vehicle is loaded only with dummies, the remainder of the required test weight shall be placed on the other axle, so that the weight on the first axle remains the same. The loading specification did not specifically address this contingency.

The requirement that the load be located in the load carrying area of multipurpose passenger vehicles, trucks, and buses during testing is deleted since the agency has determined that such a limitation is consistent with the provision specifying distribution of weight in proportion with the vehicle's gross axle weight ratings.

Petitions for reconsideration were received from eleven petitioners. Although only those comments raising issues found to be significant have been discussed, due consideration has been given to all requests. Any requests not specifically discussed herein are denied.

A substantial number of petitioners objected to the requirement that dummies used during testing be restrained only by passive means installed at the seating positions. Petitioners pointed out that mandatory passive restraint systems proposed in Standard No. 208 have a proposed effective date of September 1, 1976; one year after the September 1, 1975 effective

date set for implementation of Standard 301. This would leave a period of time when most dummies would be involved in testing while totally unrestrained. Renault, Jeep, American Motors, Mercedes-Benz, General Motors, and Ford requested that the dummies be restrained during testing by whatever means, active or passive, are installed at the particular seating positions. To provide otherwise, they argued, would unnecessarily expose the dummies to costly damage when subjected to impacts in an unrestrained condition.

The NHTSA finds petitioners' objections meritorious. Although this agency has determined that reliable test results can be best obtained when occupant weight is included in the vehicle during crash testing, the manner in which that weight is installed is subject to additional considerations. The NHTSA has made clear its desire to enable simultaneous testing under more than one standard where the test requirements are compatible. Standards 301 and 208 both require frontal and lateral barrier crash tests which can be conducted concurrently if the vehicles are loaded uniformly. Since Standard 208 provides for crash testing with dummies in vehicles with passive restraint systems, Standard 301 testing of these same vehicles should be conducted with dummies installed in the seating positions provided under Standard 208. The presence of the passive restraints will protect the dummies from unnecessary damage and the required testing for compliance with both standards can be accomplished simultaneously. Where a vehicle is not equipped with passive restraints, and Standard 208 testing is not mandated, weight equal to that of a 50th percentile test dummy should be secured to the floor pan at the front outboard designated seating positions in the vehicles being tested.

Further concern over the damage to which test dummies might be exposed was manifested by Jeep and American Motors. They petitioned for the removal of the dummies prior to the static rollover tests, arguing that their presence serves no safety-related purpose. The NHTSA has granted the request, on the basis of its determination that the dummies would have little or no effect on the fuel system's integrity during the rollover segment of the test procedure.

Jeep and American Motors further suggested that the standard specify that hardware and instrumentation be removed prior to the static rollover test in order to prevent its damage. This request is denied as unnecessary. Standard No. 301 contains no specification for the inclusion of instrumentation during testing. Any instrumentation present in the vehicle is there by decision of the manufacturer to assist him in monitoring the behavior of the fuel system during testing, and must be installed and utilized in such a manner as not to affect the test results. Therefore, as long as the loading requirements of the standard are met, manufacturers may deal with their instrumentation in any fashion they wish, as long as the test results are unaffected.

Volkswagen urged that unrestrained dummies not be required during the rear moving impact test, citing the absence of such a test in Standard 208 and alleging that the integrity of vehicle fuel systems would not be greatly affected by the presence of dummies. This request is denied. The rear moving barrier crash specified in proposed Standard 207, *Seating Systems*, provides for the installation of dummies in the same seating positions as required for Standard 301, thus permitting simultaneous conduct of the rear barrier crashes required by both standards. In order to obtain realistic and reliable test results, occupant weight must be in vehicles during Standard 301 crash testing. The NHTSA has determined that unrestrained dummies would have, at most, slight vulnerability to damage during rear barrier crash tests, since the impact is such that the seats themselves serve as protective restraint mechanisms. It has therefore been concluded that the best method for including occupant weight during rear barrier crash testing is with test dummies.

Notice 2 specified that the parking brake be engaged during the rear moving barrier crash test. Ford requested in its petition for reconsideration that this requirement be changed in order to enable simultaneous rear barrier crash testing with Standard 207 which provides for disengagement of the parking brake in its recent proposal. The NHTSA has decided to grant Ford's request. The condition of the parking brake during this test sequence would not so significantly affect the test results as to warrant

retention of a requirement that would prevent simultaneous testing.

The Recreational Vehicle Institute objected to the standard, arguing that it was not cost-effective as applied to motor homes. RVI requested that different test procedures be developed for motor home manufacturers. Specifically it objected to what it suggested was a requirement for unnecessary double testing in situations where the incomplete vehicle has already been tested before the motor home manufacturer receives it. RVI expressed the view that the motor home manufacturer should not have to concern himself with compliance to the extent that he must test the entire vehicle in accordance with the standard's test procedures.

The NHTSA has found the requirements of Standard 301 to be reasonable in that they enforce a level of safety that has been determined necessary and provide adequate lead time for manufacturers to develop methods and means of compliance. The National Traffic and Motor Vehicle Safety Act does not require a manufacturer to test vehicles by any particular method. It does require that he exercise due care in assuring himself that his vehicles are capable of satisfying the performance requirements of applicable standards when tested in the manner prescribed. This may be accomplished, however, by whatever means the manufacturer reasonably determines to be reliable. If the final stage manufacturer of a motor home concludes that additional testing by him of the entire vehicle for compliance is unnecessary, and he has exercised due care in completing the vehicle in a manner that continues its conformity to applicable standards, he is under no obligation to repeat the procedures of the standards.

RVI further pressed its contention that the standard is not cost-beneficial by arguing that the agency has not provided specific data indicating a frequency of fuel system fires in motor homes that would justify the costs imposed by the standard.

Sufficient record evidence has been found to support the conclusion that fuel spillage in the types of crashes with which the standard deals is a major safety hazard. The only basis upon which motor home manufacturers could justify the exception of their vehicles from Standard 301's requirements would be an inherent immunity from gasoline spillage. The standard establishes a reasonable test of a vehicle's ability to withstand impacts without experiencing fuel loss. If a motor home is designed in such a way as to preclude the spillage of fuel during the prescribed test impacts, compliance with the standard should present no significant hardship.

Volkswagen challenged the cost-benefit rationale of the more extensive performance requirements contained in Notice 2, and proposed that only the rear barrier crash be retained, if sufficient data exists to support its inclusion. The agency has carefully considered the issues raised in the Volkswagen petition. As discussed earlier, Standard 301 has been designed to allow testing for its requirements with some of the same barrier crash tests that are required by other standards: 208, 204, 212, and 207. This should reduce substantially the costs of testing to Standard 301, especially when viewed on a cost-per-vehicle basis. The NHTSA has concluded that the changes necessary for vehicles to comply with the standard are practicable and that the need for such increased fuel system integrity is sufficient to justify the costs.

The Recreational Vehicle Institute also urged that the effective date for motor homes be delayed 1 year beyond the date set for application of the standard to other vehicles. RVI contends that a uniform effective date for all manufacturers will create serious problems for the motor home manufacturer who will not have complying incomplete vehicles available to him until the effective date of the standard.

The NHTSA finds RVI's argument lacking in merit. Adequate lead time has been provided in Standard 301 to allow final stage manufacturers of multistage vehicles to become familiar with the requirements and to assure themselves that chassis and other vehicle components are available sufficiently in advance of the effective date to enable timely compliance. The availability of complying incomplete vehicles is a situation that should properly be resolved in the commercial dealings between motor home manufacturers and their suppliers. If the motor home manufacturer is unable to obtain complying in-

complete vehicles far enough in advance of the standard's effective date, he might, for example, work out an arrangement with his supplier whereby the supplier will provide information relating to the manner in which the incomplete vehicle must be completed in order to remain in compliance with all applicable safety standards. The lead time provided in the standards is planned to take into account the needs of persons at each stage of the manufacturing process, including final stage manufacturers.

Jeep, American Motors, and Toyota urged delays in the implementation of various aspects of the standard. Jeep suggested a new schedule for application of the standard's requirements to multipurpose passenger vehicles, trucks, and buses, stating that the current lead time is insufficient to enable completion of necessary design changes and compliance testing. American Motors requested a 1-year delay in the effective date for the static rollover test in order to allow satisfactory completion of the required Environmental Protection Agency 50,000 mile durability test. Once vehicles have completed required EPA testing and certification, their fuel system components cannot be altered. AMC says that it cannot make the design changes necessary for Standard 301 compliance in time to utilize them in this year's EPA tests. AMC also desires a 2-year delay in the frontal angular, rear, and lateral impact tests, alleging that that constitutes the minimum time necessary to produce designs that comply. Toyota asked for a delay in the frontal angular crash test for all passenger vehicles until 1978, in order to allow them sufficient time to develop a satisfactory means of compliance with the specified performance level.

All of these requests are denied. The lead time that has been provided for compliance with Standard 301 is found adequate and reasonable. The rollover requirements have been in rule form for over a year, and the more extensive requirements were proposed more than 3 years in advance of their effective dates. Considering the urgent need for stronger and more durable fuel systems, further delay of the effective dates is not justified. On the basis of all information available, the NHTSA has determined that development of complying fuel systems can be attained in the time allowed. In addition, Congress has expressed in the recently enacted amendments to the National Traffic and Motor Vehicle Safety Act its decision that the effective dates specified in Notice 2 should be strictly adhered to.

Toyota requested that the requirements of the rear moving barrier crash not be imposed on vehicles with station wagon or hatch-back bodies, alleging difficulty in relocation of the fuel tank to an invulnerable position. The request is denied as the NHTSA has determined that satisfaction of the rear barrier crash requirements by station wagons and hatch-backs is practicable and necessary.

Volkswagen raised several objections in its petition to the static rollover test, including assertions that the test does not reflect real world accidents, and that the test procedure is unclear since the direction of rotation is unspecified.

The NHTSA does not consider these arguments to be germane. It is true that the static rollover test, like any "static" test, is not designed as a simulation of the actual behavior of a vehicle in a dynamic crash situation. It is intended rather as a laboratory method of quantitatively measuring the vehicle properties that contribute to safety in a range of crash situations. The NHTSA has found that a vehicle's performance in the static rollover test is directly related to the fuel system integrity that is the goal of the standard, and is an appropriate means of measuring that aspect of performance.

With regard to the direction of rotation, the NHTSA has stipulated that only a cetrain amount of fuel may escape during a 360° rotation of a vehicle on its longitudinal axis. The vehicle must be capable of meeting this performance level regardless of the direction of its rotation.

British Leyland (in a petition for rulemaking) and Volkswagen requested revision of the aspect of the barrier crash requirement limiting the amount of fuel spillage taking place from impact until motion of the vehicle has ceased. They stated that the current 1-ounce limitation is too difficult to measure in the period while the vehicle is moving and suggested that fuel spillage be averaged over the period from impact until 5 minutes following the cessation of motion.

The NHTSA must deny this request. The purpose of the current limitation on the spillage of fuel during the impact and post-impact motion is to prohibit the sudden loss of several ounces of fuel which might occur, as an example, by the displacement of the filler cap. Simultaneous loss of several ounces of fuel during the impact and subsequent vehicle motion could have a fire-causing potential, because of sparks that are likely to be given off during a skid or metal contact between vehicles.

Chrysler petitioned to have the requirement specifying that the moving barrier be guided during the entire impact sequence deleted in favor of a requirement that would allow the termination of guidance of the barrier immediately prior to impact. They argued that their suggested procedure is more representative of real world impacts.

The request is denied. The condition that there be no transverse or rotational movement of the barrier, which has been in effect since January 1, 1972, eliminates random variations between different tests and therefore makes the standard more repeatable and objective as required by the statute.

Jeep requested clarification that a given vehicle is only required to be subjected to one of the specified barrier impacts followed by a static rollover. This request is granted as it follows the agency's intent and the standard is not specific on that point. Section S6. is amended to require that a single vehicle need only be capable of meeting a single crash test followed by a static rollover.

American Motors submitted a request that the agency finds repetitious of previous petitions, urging that vehicle fluids be stabilized at ambient temperatures prior to testing. In responding to earlier petitions for reconsideration from MVMA and GM in Notice 1, the NHTSA denied a request for temperature specification, stating that it intended that the full spectrum of temperatures encountered on the road be reflected in the test procedure. That continues to be this agency's position.

In light of the foregoing S3., S6., S6.1, S6.3, S7.1.4, and S7.1.5 of Standard No. 301, *Fuel System Integrity*, (49 CFR 571.301) are amended . . .

Effective date: September 1, 1975, with additional requirements effective September 1, 1976 and September 1, 1977, as indicated.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718, 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.51.)

Issued on November 15, 1974.

James B. Gregory
Administrator

39 F.R. 40857
November 21, 1974

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301–75

Fuel System Integrity

(Docket No. 73–20; Notice 6)

This notice amends Standard No. 301, *Fuel System Integrity* (49 CFR 571.301), to specify new loading conditions and to establish a 30-minute fuel spillage measurement period following barrier crash tests.

On April 16, 1975, the NHTSA published a notice (40 F.R. 17036) proposing a revision of the loading conditions and fuel spillage measurement period requirement in Standard 301. The NHTSA also proposed in that notice an extension of the applicability of Standard 301 to school buses with a GVWR in excess of 10,000 pounds. At the request of several Members of Congress, the due date for comments on the school bus proposal was extended to June 26, 1975, and final rulemaking action on it will appear in a later Federal Register notice.

It was proposed that the current 15-minute fuel spillage measurement period be extended to 30 minutes in order to allow more time for leaks to be located and rates of flow to be established. Measurement of fuel loss during only a 15 minute time period is difficult because fuel may be escaping from various parts of the vehicle where it is not readily detectable. Chrysler, American Motors, and General Motors objected to the proposed change and asked that it either not be adopted or that adoption be delayed for one year until September 1, 1976.

The commenters argued that the revision was unnecessary and would involve a change in their testing methods. The NHTSA has fully considered these arguments and does not consider the amendment to prescribe a higher level of performance. It concludes that the 30-minute measurement period is necessary to achieve accurate measurement of fuel loss and assessment of vehicle compliance and accordingly amends Standard 301 to prescribe the longer period for measurement.

The April 16, 1975, notice also proposed a change in the Standard 301 loading conditions to specify that 50th percentile test dummies be placed in specified seating positions during the frontal and lateral barrier crash tests, and that they be restrained by means installed in the vehicle for protection at the particular seating position. Currently the standard requires (during the frontal and lateral barrier crash tests) ballast weight secured at the specified designated seating positions in vehicles not equipped with passive restraint systems. In vehicles equipped with passive restraints, 50th percentile test dummies are to be placed in the specified seating positions during testing.

In petitions for reconsideration of this amendment to Standard No. 301 (39 F.R. 40857) various motor vehicle manufacturers stated that attachment of such ballast weight to the vehicle floor pans during the barrier crashes would exert unrealistic stresses on the vehicle structure which would not exist in an actual crash. The NHTSA found merit in petitioners' arguments, and its proposed revision of the loading conditions is intended to make the crash tests more representative of real-life situations.

Only Mazda objected to the proposal. It argued that curb weight be prescribed as the loading condition so that it could conduct Standard 301 compliance testing concurrently with testing for Standards No. 212 and 204. The NHTSA does not find merit in Mazda's request as the Standard 301 loading condition is considered necessary to assure an adequate level of fuel system integrity. Since the proposed loading conditions are more stringent than a curb weight

condition, manufacturers could conduct compliance testing for Standards 301, 212, and 204 simultaneously. If the vehicle complied with the requirements of Standards 212 and 204 when loaded according to 301 specifications, the manufacturer presumably could certify the capability of the vehicles to comply with the performance requirements of 212 and 204 when loaded to curb weight. It should be noted that the NHTSA is considering amending Standards 212 and 204 to specify the same loading conditions as proposed for Standard 301.

All other commenters supported immediate adoption of the proposed loading conditions. Therefore, the NHTSA adopts the loading conditions as they were proposed in the April 16, 1975, notice.

In consideration of the foregoing, S5.5 and S7.1.6 of Motor Vehicle Safety Standard No. 301, *Fuel System Integrity* (49 CFR 571.301), are amended to read as follows:

Effective date: Because this amendment revises certain requirements that are part of 49 CFR 571.301–75, Motor Vehicle Safety Standard 301–75, effective September 1, 1975, and creates no additional burden upon any person, it is found for good cause shown that an effective date of less than 180 days after publication is in the public interest.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.51.)

Issued August 1, 1975.

Robert L. Carter
Acting Administrator

40 F.R. 33036
August 6, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301-75

Fuel System Integrity

(Docket No. 73-20; Notice 7)

This notice responds to a petition for reconsideration of the notice published August 6, 1975 (40 FR 33036), which amended Standard No. 301, *Fuel System Integrity* (49 CFR 571.301), to specify new loading conditions and establish a 30-minute fuel spillage measurement period following a barrier crash test.

American Motors Corporation (AMC) has petitioned for reconsideration of the amendment to S5.5 of Standard No. 301 insofar as it establishes an effective date of September 1, 1975, for the 30-minute fuel spillage requirement. AMC requests that the effective date for the 30-minute fuel spillage measurement time be delayed for 180 days from the date of publication of the rule.

The NHTSA has determined that AMC's petition has merit. AMC argues that the imposition of an effective date 25 days after the publication of the rule is burdensome because the 30-minute spillage requirement is a more stringent requirement than the previous 15-minute requirement and therefore requires additional testing to determine compliance. The NHTSA agrees that 25 days is not enough time to complete the additional testing. However, the effective date will be postponed 12 months instead of the 6 months requested by AMC so that manufacturers will not have to conduct compliance testing for 1976 model vehicles already certified under the old 15-minute spillage requirement. For these reasons the petition of American Motors Corporation is granted.

In S5.5 of Standard No. 301, *Fuel System Integrity*, (49 CFR 571.301), the amendment of August 6, 1975 (40 FR 33036), changing the term "10-minute period" to "25-minute period" effective September 1, 1975, is hereby made effective September 1, 1976.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.51).

Issued on October 3, 1975.

Gene G. Mannella
Acting Administrator

40 F.R. 47790
October 10, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301-75

Fuel System Integrity

(Docket No. 73-20; Notice 8)

The purpose of this notice is to amend Motor Vehicle Safety Standard No. 301, *Fuel System Integrity* (49 CFR 571.301) to extend the applicability of the standard to school buses with a GVWR in excess of 10,000 pounds. The amendment specifies conditions for a moving contoured barrier crash for school buses in order to determine the amount of fuel spillage following impact.

On October 27, 1974, the Motor Vehicle and Schoolbus Safety Amendments of 1974, amending the National Traffic and Motor Vehicle Safety Act, were signed into law (Pub. L. 93-492, 88 Stat. 1470). Section 103(i)(1)(A) of the Act, as amended, orders the promulgation of a safety standard establishing minimum requirements for the fuel system integrity of school buses. Standard No. 301 currently contains requirements for school buses with a GVWR of 10,000 pounds or less which will become effective beginning September 1, 1976. Larger school buses, which comprise approximately 90 percent of the school bus population, will be included in Standard No. 301 by this amendment.

A proposal to amend Standard No. 301 with respect to school buses, loading conditions, and spillage measurement time was published on April 16, 1975 (40 FR 17036). An amendment to the Standard specifying certain loading conditions and establishing a 30-minute fuel spillage measurement period was published on August 6, 1975 (40 FR 33036). At the request of several members of Congress, the period for comments on the school bus proposals was extended. This notice responds to the comments received with respect to the inclusion of school buses within the requirements of the standard.

Seven manufacturers opposed the requirement of a single impact test by a moving contoured barrier at any point on the school bus body, arguing that such a requirement would necessitate a proliferation of expensive tests in order to ensure compliance at every conceivable point of impact. The NHTSA does not agree. Although not specifying a particular impact point, the test condition allows for testing at the few most vulnerable points of each kind of school bus fuel system configuration. Therefore, only impacts at those points are necessary to determine compliance. On the basis of its knowledge of the bus design, a manufacturer should be able to make at least an approximate determination of the most vulnerable points on the bus body.

Two school bus body manufacturers requested a requirement that the manufacturer who installs the fuel system be responsible for compliance testing, while one chassis manufacturer argued that responsibility for compliance should rest with the final manufacturer. In most cases, if the basic fuel system components are included in the chassis as delivered by its manufacturer, the multistage vehicle regulations of 49 CFR Part 568 require the chassis manufacturer at least to describe the conditions under which the completed vehicle will conform, since it could not truthfully state that the design of the chassis has no substantial determining effect on conformity. Beyond that, however, the NHTSA position is that the decision as to who should perform the tests and who should take the responsibility is best not regulated by the government. The effect of Part 568 is to allow the final-stage manufacturer to avoid primary responsibility for conformity to a standard if it completes the vehicle in accordance with the conditions or instructions furnished with the incomplete vehicle by its man-

ufacturer. Whether it does so is a decision it must make in light of all the circumstances.

This notice extends the proposed exclusion for vehicles that use fuel with a boiling point below 32° F. to school buses having a GVWR greater than 10,000 pounds. Fuel systems using gaseous fuels are not subject to the spillage problems against which this standard is directed.

The Vehicle Equipment Safety Commission requested that school buses be required to undergo static rollover tests and that the engine be running during the tests. Upon consideration, the NHTSA finds that a static rollover test for school buses is impractical in light of the expensive test facility that would be required. A requirement that the engine be running during the impact test would make little difference in the resulting fuel spillage. Since the standard requires that the fuel tank be filled with Stoddard solvent during the impact test, the test vehicle would have to be equipped with an auxiliary fuel system for the engine. The expense of modifying the test vehicle to allow the engine to run during the test would not justify the minimal benefits resulting from a requirement that the engine be running. However, the fuel system integrity of school buses will be continually monitored and analyzed by the NHSTA. Therefore, suggestions such as these may be the subject of future rulemaking.

One school bus body manufacturer cited the infrequency of school bus fires resulting from collisions as a reason for ameliorating or eliminating altogether fuel system integrity requirements for school buses. In promulgating these amendments to Standard No. 301, the NHTSA is acting under the statutory mandate to develop regulations concerning school bus fuel systems. This statute reflects the need, evidently strongly felt by the public, to protect the children who ride in the school buses. They and their parents have little direct control over the types of vehicles in which they ride to school, and are therefore not in a position to determine the safety of the vehicles. Considering the high regard expressed by the public for the safety of its children, the NHTSA finds it important that the school bus standards be effective and meaningful.

The California Highway Patrol expressed the concern that these amendments would preempt State regulations to the extent that the State would be precluded from specifying the location of fuel tanks, fillers, vents, and drain openings in school buses. The standard will unavoidably have that effect, by the operation of section 103(d) of the National Traffic and Motor Vehicle Safety Act. However, although a State may not have regulations of general applicability that bear on these aspects of performance, the second sentence of the same section makes it clear that a State or political subdivision may specify higher standards of performance for vehicles purchased for its own use, although of course the Federal standards must be met in any case.

In addition to provisions directly relating to school buses, this notice clarifies the loading condition amendments in the notice of August 6, 1975, by amending S6.1 to provide for testing with 50th percentile dummies. The wording of S6.1 is identical to that of the proposal.

In light of the foregoing, 49 CFR 571.301, Motor Vehicle Safety Standard No. 301, is amended. . . .

Effective date: July 15, 1976, in conformity with the schedule mandated by the 1974 Amendments to the Traffic Safety Act. However, the effective date of the amendment of S6.1 is October 15, 1975. Because the amendment to that paragraph clarifies the revision of certain requirements which became effective September 1, 1975, it is found for good cause shown that an effective date for the amendment of S6.1 less than 180 days after issuance is in the public interest.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 202, Pub. L. 93-492, 88 Stat. 1470 (15 U.S.C. 1392); delegations of authority at 49 CFR 1.51 and 501.8).

Issued on October 8, 1975.

Gene G. Mannella
Acting Administrator

40 F.R. 48352
October 15, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301–75

Fuel System Integrity

(Docket No. 73–20; Notice 9)

This notice clarifies the effective date of the change in Standard No. 301–75 (49 CFR 571.301–75) from a 15-minute to a 30-minute fuel spillage measurement period following cessation of motion in barrier crash tests.

Until August 1975, S5.4 of Standard No. 301–75 specified a 15-minute fuel spillage measurement period for the barrier crash test requirements that would become effective September 1, 1975. To allow more time for leaks to be located and rates of flow to be established, that period was extended to 30 minutes in Notice 6 (40 FR 33036, August 6, 1975; correction of section numbers at 40 FR 37042, August 25, 1975). Notice 6 set the effective date of the change as September 1, 1975.

In response to a petition for reconsideration filed by American Motors Corporation, the NHTSA in Notice 7 (40 FR 47790; October 10, 1975) delayed for 1 year the effective date of that change, thereby establishing the following scheme: a 15-minute period would be used in applying the standard to vehicles manufactured before September 1, 1976, while a 30-minute measurement period would be used for vehicles manufactured after that date.

In Notice 8, which was published on October 15, 1975 (40 FR 48352), the loading conditions of S6.1 were revised, effective immediately, and the standard was extended to apply to school buses with a GVWR in excess of 10,000 pounds, effective July 15, 1976. Because these amendments were made by republishing the entire text of the standard, it appeared that the effective date of the change from a 15-minute measurement period to a 30-minute measurement period had been advanced from September 1, 1976, to July 15, 1976, for all vehicles. The NHTSA did not intend such an advancement, and this notice amends the standard to reestablish the September 1, 1976, effective date for vehicles other than school buses with a GVWR greater than 10,000 pounds.

The following corrections of Notice 8 are also made: the standard is designated as "Standard No. 301–75" and typographical errors in S6.4 and S7.5.2 are corrected.

In consideration of the foregoing, § 571.301 of 49 CFR Part 571 (Standard No. 301, *Fuel System Integrity*), as published in the issue of October 15, 1975 (40 FR 48352), is redesignated as § 571.301–75 and amended. . . .

Effective dates: As set forth in the standard. Changes indicated in the text of the Code of Federal Regulations should be made immediately.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Sec. 108, Pub. L. 93–492, 88 Stat. 1470 (15 U.S.C. 1392 note); delegation of authority at 49 CFR 1.50.)

Issued on February 25, 1976.

James B. Gregory
Administrator

41 F.R. 9350
March 4, 1976

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 301-75

Fuel System Integrity

(Docket No. 73-03; Notice 07); Docket No. 73-20; Notice 010); (Docket No. 73-34; Notice 04); (Docket No. 75-02; Notice 03); (Docket No. 75-03; Notice 05); (Docket No. 75-07; Notice 03); (Docket No. 75-24; Notice 03)

This notice announces that the effective dates of the redefinition of "school bus" and of six Federal motor vehicle safety standards as they apply to school buses are changed to April 1, 1977, from the previously established effective dates. This notice also makes a minor amendment to Standard No. 220, *School Bus Rollover Protection*, and adds a figure to Standard No. 221, *School Bus Body Joint Strength.*

The Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Act) mandated the issuance of Federal motor vehicle safety standards for several aspects of school bus performance, Pub. L. 93-492, § 202 (15 U.S.C. § 1392(i)(1)(A)). These amendments included a definition of school bus that necessitated a revision of the existing definition used by the NHTSA in establishing safety requirements. The Act also specified that the new requirements "apply to each schoolbus and item of schoolbus equipment which is manufactured . . . on or after the expiration of the 9-month period which begins on the date of promulgation of such safety standards." (15 U.S.C. § 1392(i)(1)(B)).

Pursuant to the Act, amendments were made to the following standards: Standard No. 301-75, *Fuel System Integrity* (49 CFR 571.301-75), effective July 15, 1976, for school buses not already covered by the standard (40 FR 483521, October 15, 1975); Standard No. 105-75, *Hydraulic Brake Systems* (49 CFR 571.105-75), effective October 12, 1976 (41 FR 2391, January 16, 1976); and Standard No. 217, *Bus Window Retention and Release* (49 CFR 571.217), effective for school buses on October 26, 1976 (41 FR 3871, January 27, 1976).

In addition, the following new standards were added to Part 571 of Title 49 of the Code of Federal Regulations, effective October 26, 1976: Standard No. 220, *School Bus Rollover Protection* (41 FR 3874, January 27, 1976); Standard No. 221, *School Bus Body Joint Strength* (41 FR 3872, January 26, 1976); and Standard No. 222, *School Bus Passenger Seating and Crash Protection* (41 FR 4016, January 28, 1976). Also, the existing definition of "school bus" was amended, effective October 27, 1976, in line with the date set by the Act for issuance of the standards.

The Act was recently amended by Public Law 94-346 (July 8, 1976) to change the effective dates of the school bus standards to April 1, 1977 (15 U.S.C. § 1392(i)(1)(B)). This notice is intended to advise interested persons of these changes of effective dates. In the case of Standard No. 301-75, the change of effective date is reflected in a conforming amendment to S5.4 of that standard. A similar amendment is made in S3 of Standard No. 105-75.

The agency concludes that the October 27, 1976, effective date for the redefinition of "school bus" should be postponed to April 1, 1977, to conform to the new effective dates for the upcoming requirements. If this were not done, the new classes of school buses would be required to meet existing standards that apply to school buses (e.g., Standard No. 108 (49 CFR 571.108)) before being required to meet the new standards. This would result in two stages of compliance, and would complicate the redesign efforts that Congress sought to relieve.

This notice also amends Standard No. 220 in response to an interpretation request by Blue Bird Body Company, and Sheller-Globe Corporation's petition for reconsideration of the standard. Both companies request confirmation that the standard's requirement to operate emergency exits during the application of force to the vehicle roof (S4(b)) does not apply to roof exits which are covered by the force application plate. The agency did not intend to require the operation of roof exits while the force application plate is in place on the vehicle. Accordingly, an appropriate amendment has been made to S4(b) of the standard.

With regard to Standard No. 220, Sheller-Globe also requested information that, in testing its school buses that have a gross vehicle weight rating (GVWR) of 10,000 pounds or less, it may test with a force application plate with dimensions other than those specified in the standard. The standard does not prohibit a manufacturer from using a different dimension from that specified, in view of the NHTSA's expressed position on the legal effect of its regulations. To certify compliance, a manufacturer is free to choose any means, in the exercise of due care, to show that a vehicle (or item of motor vehicle equipment) would comply if tested by the NHTSA as specified in the standard. Thus the force application plate used by the NHTSA need not be duplicated by each manufacturer or compliance test facility. Sheller-Globe, for example, is free to use a force application plate of any width as long as it can certify its vehicle would comply if tested by the NHTSA according to the standard.

In a separate area, the agency corrects the inadvertent omission of an illustration from Standard No. 221 as it was issued January 26, 1976 (41 FR 3872). The figure does not differ from that proposed and, in that form, it received no adverse comment.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 FR 16200, April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this action on the public and private sectors, including possible loss of safety benefits. The changes in effective dates for the school bus standards are not evaluated because they were accomplished by law and not by regulatory action.

The change of effective date for the redefinition of "school bus" will result in savings to manufacturers who will not be required to meet existing school bus standards between October 27, 1976, and April 1, 1977. The agency calculates that the only standard that would not be met would be the requirement in Standard No. 108 for school bus marker lamps. In view of the agency's existing provision for the marking of night school buses in Pupil Transportation Standard No. 17 (23 CFR 1204), it is concluded that the absence of this equipment until April 1, 1977, will not have a significant adverse impact on safety.

The interpretative amendment of Standard No. 220 and the addition of a figure to Standard No. 221 are not expected to affect the manufacture or operation of school buses.

In consideration of the foregoing, Part 571 of Title 49 of the Code of Federal Regulations is amended....

Effective dates:

1. Because the listed amendments do not impose additional requirements of any person, the National Highway Traffic Safety Administration finds that an immediate effective date of August 26, 1976 is in the public interest.

2. The effective date of the redefinition of "school bus" in 49 CFR Part 571.3 that was published in the issue of December 31, 1976 (40 FR 60033) is changed to April 1, 1977.

3. The effective dates of Standard Nos. 105–75, 217, 301–75, 220, 221, and 222(as they apply to school buses) are April 1, 1977, in accordance with Public Law 94–346.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); Pub. L. 94–346, Stat. (15 U.S.C. § 1392(i)(1)(B)); delegation of authority at 49 CFR 1.50.)

Issued on August 17, 1976.

John W. Snow
Administrator

41 F.R. 36026
August 26, 1976

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 301

Fuel; System Integrity

[Docket No. 88-01; Notice 01]

ACTION: Technical amendment; final rule

SUMMARY: This notice makes a technical amendment to Figure 2 of Standard No. 301 to correct the ground clearance dimension specified in the figure for moving contoured barrier used in testing the fuel system integrity of school buses. Currently, Figure 2 specifies the ground clearance to the lower edge of the contoured impact surface as 12.25 inches (311 mm.). The text of the standard refers to the same dimension as 5.25 ± 0.5 inches. This amendment corrects Figure 2 to reflect the agency's intent that the ground clearance to the lower edge of the contoured impact surface is 5.25 inches (133 mm.).

EFFECTIVE DATE: April 13, 1988.

SUPPLEMENTARY INFORMATION: The Blue Bird Body Company (Blue Bird), a school bus manufacturer, has brought to the agency's attention that corrective action should be taken to remedy a discrepancy in the moving contoured barrier specifications in Standard No. 301. Blue Bird informed the agency that there appeared to be a conflict in the standard about the correct ground clearance of the contoured impact surface used in the school bus impact test of the standard. Paragraph S7.5.1 of the standard refers to the dimension between the ground to the lower edge of the impact surface as 5.25 ± 0.5 inches, while Figure 2 of the standard shows the ground clearance to be 12.25.

This amendment corrects Figure 2 to reflect the agency's intent that the ground clearance to the lower edge of the contoured impact surface is 5.25 inches (133 mm.). NHTSA adopted the use of the contoured barrier in a final rule issued on October 15, 1975 (40 FR 48352). In the April 16, 1975, proposal to the rule (40 FR 17036), NHTSA stated that:

> The contoured barrier would incorporate the moving barrier specifications of SAE Recommended Practice J972a (March 1973). However, the impact surface of the barrier would be at a height 30 inches above the ground level, rather than 37 inches as specified in the SAE provision. Studies have shown that a 30-inch test height is more representative of actual collisions. This would be a typical engine height of vehicles that might impact a school bus.

Thus, in S7.5.1 of the standard, the agency adopted the ground clearance as 5.25 inches ± 0.5 inches to ensure that the top of the barrier would be 30 inches from the ground. In Figure 2, the agency apparently inadvertently incorporated the barrier dimensions directly from the SAE Recommended Practice J972a, without making the necessary 7 inch adjustment in the ground clearance dimension.

The agency has therefore concluded that a technical correction to Figure 2 is required to reflect NHTSA's true intent. The agency is amending the table marked "Dimensions" in the figure by changing the "12.25" inch and "311" mm. dimensions for letter "d" (referring to the distance between the ground to the lower edge of the impact surface) to "5.25" inches, and "133" mm., respectively.

Because the amendment is corrective in nature and imposes no additional burden upon any person, it is hereby found that notice and comment thereon are not necessary, and that for good cause shown an effective date earlier than 180 days after issuance of the rule is in the public interest. The amendment is effective upon 30 days after publication in the *Federal Register*.

NHTSA has considered this amendment and has determined that it is not major within the meaning of Executive Order 12291 "Federal Regulation" or significant under Department of Transportation regulatory policies and procedures, and that neither a regulatory impact analysis nor a regulatory evaluation is required. The amendment imposes no additional requirements nor alters the cost impacts of requirements already adopted.

NHTSA has analyzed this rule for purposes of the National Environmental Policy Act. The rule will have no effect on the human environment since it clarifies an existing requirement.

The agency has also considered the impact of this amendment under the Regulatory Flexibility

Act. I certify that the amendment will not have a significant economic impact on a substantial number of small entities. Accordingly, no regulatory flexibility analysis has been prepared. Manufacturers of motor vehicles, those businesses affected by the amendment, generally are not small businesses within the meaning of the Regulatory Flexibility Act. Any manufacturer who is a small business within the meaning of the Act will not be significantly affected since this corrective amendment only clarifies a previously adopted requirement and imposes no additional requirements. Finally, small organizations and governmental jurisdictions will not be affected by this amendment since prices will not be impacted.

In consideration of the foregoing, Figure 2 of Part 571 is amended.

Issued on March 8, 1988

Barry Felrice
Associate Administrator
for Rulemaking

53 F.R. 8202
March 14, 1988

PREAMBLE TO AN AMENDMENT TO FEDERAL MOTOR VEHICLE SAFETY STANDARD 301 FUEL SYSTEM INTEGRITY; CORRECTION

(Docket No. 73-20; Notice 12)

ACTION: Technical correction.

SUMMARY: This notice corrects a typographical error in 49 CFR § 571.301, *Fuel System Integrity*, concerning the application of the standard to large school buses. This standard limits the amount of fuel spillage that can occur from vehicle fuel systems during and after specified front, rear, and lateral barrier impact tests.

EFFECTIVE DATE: December 12, 1988.

SUPPLEMENTARY INFORMATION: The agency has become aware of a typographical error in paragraph S3, *Application*, of Federal Motor Vehicle Safety Standard No. 301, *Fuel System Integrity* (Title 49 of the Code of Federal Regulations (CFR), § 571.301). Standard No. 301 limits the amount of fuel spillage that can occur from fuel systems of vehicles subject to the standard during and after specified front, rear, and lateral barrier impact tests.

Paragraph S3 should state: "This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks, and buses that have a GVWR of 10,000 pounds or less and use fuel with a boiling point *above* 32° F." (Emphasis added.) However, as published in the CFR, the latter portion of S3 states: ". . . and to schoolbuses that have a GVWR greater than 10,000 pounds and fuel with a boiling point *about* 32° F."

The change in wording occurred between the issuance and publication of the final rule establishing Standard No. 301. On October 8, 1975, NHTSA issued for publication in the *Federal Register* the final rule which established the application of Standard No. 301 to school buses over 10,000 pounds GVWR, and amended paragraph S3 to reflect that application. As issued, the wording in question in paragraph S3 read "above 32° F." This was in accord with the preamble to the final rule, which stated that: "This notice extends the proposed exclusion for vehicles that use fuel with a boiling point below 32° F. to school buses having a GVWR greater than 10,000 pounds." 40 FR 48352; October 15, 1975. However, as published, the final rule used the word "about" instead of "above" with respect to those more heavily rated school buses. This notice corrects that error.

Issued on December 7, 1988.

Diane K. Steed
Administrator

53 F.R. 49989
December 13, 1988

MOTOR VEHICLE SAFETY STANDARD NO. 301

Fuel System Integrity

S1. Scope. This standard specifies requirements for the integrity of motor vehicle fuel systems.

S2. Purpose. The purpose of this standard is to reduce deaths and injuries occurring from fires that result from fuel spillage during and after motor vehicle crashes.

S3. Application. This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks, and buses that have a GVWR of 10,000 pounds or less and use fuel with a boiling point above 32° F., and to school buses that have a GVWR greater than 10,000 pounds and use fuel with a boiling point above 32° F.

S4. Definition. "Fuel spillage" means the fall, flow, or run of fuel from the vehicle but does not include wetness resulting from capillary action.

S5. General requirements.

S5.1 Passenger cars. Each passenger car manufactured from September 1, 1975, to August 31, 1976, shall meet the requirements of S6.1 in a perpendicular impact only, and S6.4. Each passenger car manufactured on or after September 1, 1976, shall meet all the requirements of S6, except S6.5.

S5.2 Vehicles with GVWR of 6,000 pounds or less. Each multipurpose passenger vehicle, truck, and bus with a GVWR of 6,000 pounds or less manufactured from September 1, 1976, to August 31, 1977, shall meet all the requirements of S6.1 in a perpendicular impact only, S6.2, and S6.4. Each of these types of vehicles manufactured on or after September 1, 1977, shall meet the requirements of S6, except S6.5.

S5.3 Vehicles with GVWR of more than 6,000 pounds but not more than 10,000 pounds. Each multipurpose passenger vehicle, truck, and bus with a GVWR of more than 6,000 pounds but not more than 10,000 pounds manufactured from September 1, 1976, to August 31, 1977, shall meet the requirements of S6.1 in a perpendicular impact only. Each vehicle manufactured on or after September 1, 1977, shall meet all the requirements of S6, except S6.5.

S5.4 School buses with a GVWR greater than 10,000 pounds. Each school bus with a GVWR greater than 10,000 pounds manufactured on or after April 1, 1977, shall meet the requirements of S6.5.

S5.5 Fuel spillage: Barrier crash. Fuel spillage in any fixed or moving barrier crash test shall not exceed 1 ounce by weight from impact until motion of the vehicle has ceased, and shall not exceed a total of 5 ounces by weight in the 5-minute period following cessation of motion. For the subsequent 25-minute period (for vehicles manufactured before September 1, 1976, other than school buses with a GVWR greater than 10,000 pounds: the subsequent 10-minute period), fuel spillage during any 1-minute interval shall not exceed 1 ounce by weight.

S5.6 Fuel spillage: Rollover. Fuel spillage in any rollover test, from the onset of rotational motion, shall not exceed a total of 5 ounces by weight for the first 5 minutes of testing at each successive 90° increment. For the remaining testing period, at each increment of 90° fuel spillage during any 1-minute interval shall not exceed 1 ounce by weight.

S6. Test requirements. Each vehicle with a GVWR of 10,000 pounds or less shall be capable of meeting the requirements of any applicable

barrier crash test followed by a static rollover, without alteration of the vehicle during the test sequence. A particular vehicle need not meet further requirements after having been subjected to a single barrier crash test and a static rollover test.

S6.1 Frontal barrier crash. When the vehicle traveling longitudinally forward at any speed up to and including 30 mph impacts a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30° in either direction from the perpendicular to the line of travel of the vehicle, with 50th-percentile test dummies as specified in Part 572 of this chapter at each front outboard designated seating position and at any other position whose protection system is required to be tested by a dummy under the provisions of Standard No. 208, under the applicable conditions of S7, fuel spillage shall not exceed the limits of S5.5. (Effective: October 15, 1975)

S6.2 Rear moving barrier crash. When the vehicle is impacted from the rear by a barrier moving at 30 mph, with test dummies as specified in Part 572 of this chapter at each front outboard designated seating position, under the applicable conditions of S7, fuel spillage shall not exceed the limits of S5.5.

S6.3 Lateral moving barrier crash. When the vehicle is impacted laterally on either side by a barrier moving at 20 mph with 50th-percentile test dummies as specified in Part 572 of this chapter at positions required for testing to Standard No. 208, under the applicable conditions of S7, fuel spillage shall not exceed the limits of S5.5.

S6.4 Static rollover. When the vehicle is rotated on its longitudinal axis to each successive increment of 90°, following an impact crash of S6.1, S6.2, or S6.3, fuel spillage shall not exceed the limits of S5.6.

S6.5 Moving contoured barrier crash. When the moving contoured barrier assembly traveling longitudinally forward at any speed up to and including 30 mph impacts the test vehicle (school bus with a GVWR exceeding 10,000 pounds) at any point and angle, under the applicable conditions of S7.1 and S7.5, fuel spillage shall not exceed the limits of S5.5.

S7. Test conditions. The requirements of S5 and S6 shall be met under the following conditions. Where a range of conditions is specified, the vehicle must be capable of meeting the requirements at all points within the range.

S7.1 General test conditions. The following conditions apply to all tests:

S7.1.1 The fuel tank is filled to any level from 90 to 95 percent of capacity with Stoddard solvent, having the physical and chemical properties of type 1 solvent, Table I ASTM Standard D484–71, "Standard Specifications for Hydrocarbon Dry Cleaning Solvents."

S7.1.2 The fuel system other than the fuel tank is filled with Stoddard solvent to its normal operating level.

S7.1.3 In meeting the requirements of S6.1 through S6.3, if the vehicle has an electrically driven fuel pump that normally runs when the vehicle's electrical system is activated, it is operating at the time of the barrier crash.

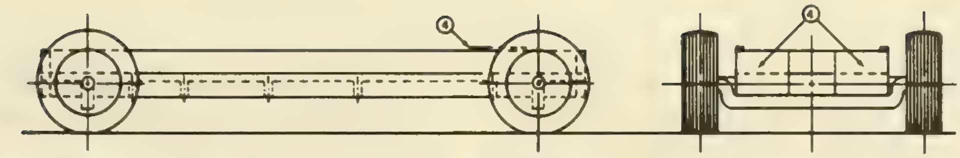
S7.1.4 The parking brake is disengaged and the transmission is in neutral, except that in meeting the requirements of S6.5 the parking brake is set.

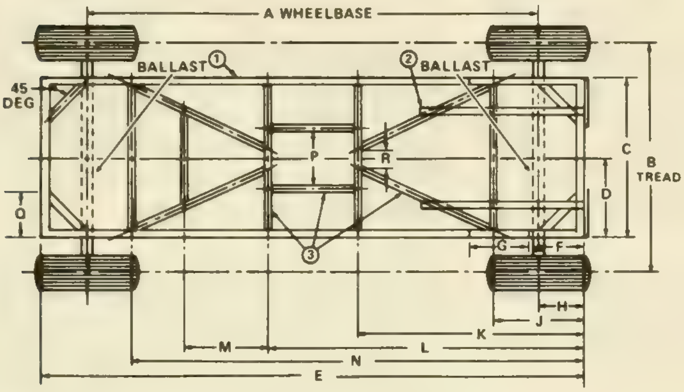
S7.1.5 Tires are inflated to manufacturer's specifications.

S7.1.6 The vehicle, including test devices and instrumentation, is loaded as follows:

(a) Except as specified in S7.1.1, a passenger car is loaded to its unloaded vehicle weight plus its rated cargo and luggage capacity weight, secured in the luggage area, plus the necessary test dummies as specified in S6, restrained only by means that are installed in the vehicle for protection at its seating position.

(b) Except as specified in S7.1.1, a multipurpose passenger vehicle, truck, or bus with a GVWR of 10,000 pounds or less is loaded to its unloaded vehicle weight, plus the necessary test dummies, as specified in S6, plus 300 pounds of its rated cargo and luggage capacity weight, whichever is less, secured to the vehicle and dis-





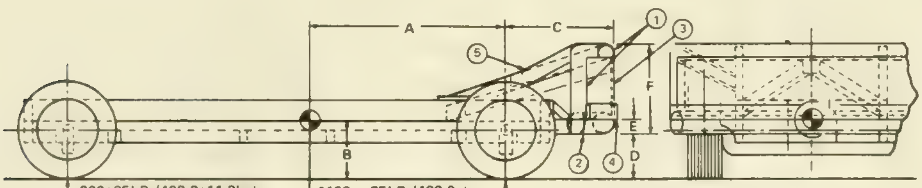
Letter	In	mm
A	120.0	3048
B	60.0	1524
C	42.0	1067
D	21.0	533
E	144.0	3658
F	15.0	381
G	16.0	406
H	12.0	305
J	24.0	610
K	60.0	1524
L	84.0	2134
M	22.0	559
N	120.0	3048
P	16.0	406
Q	12.0	305
R	6.0	152

DIMENSIONS

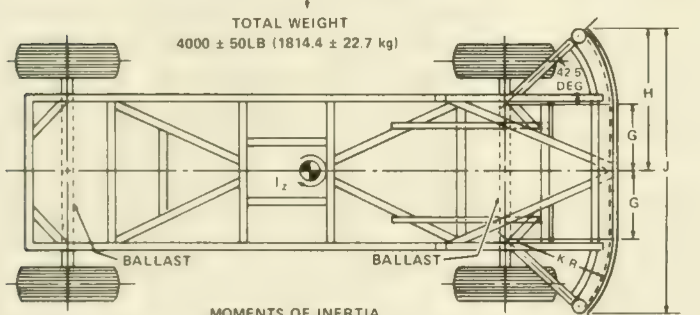
NOTES:

1. OUTER FRAME 6.0 X 2.0 X 0.19 IN (152 X 51 X 5 mm) STEEL TUBING, TWO PIECES WELDED TOGETHER FOR A 12.0 IN (305 mm) HEIGHT.
2. BALLAST TIE DOWNS.
3. ALL INNER REINFORCEMENTS AND FRAME GUSSETS OF 4.0 X 2.0 X 0.19 IN (102 X 51 X 5 mm) STEEL TUBING.
4. REINFORCE AREAS FOR BOLTING ON FACE PLATES.

FIG. 1–COMMON CARRIAGE FOR MOVING BARRIERS



TOTAL WEIGHT
4000 ± 50LB (1814.4 ± 22.7 kg)



DIMENSIONS

Letter	In	mm
A	54.0	1372
B	15.8	401
C	30.0	762
D	5.25	133
E	3.75	95
F	24.75	629
G	18.0	457
H	39.0	991
J	78.0	1981
K	30.0	762

MOMENTS OF INERTIA

I_x = 271 ± 13.6 SLUG • FT² (367 ± 18.4 kg • m²)

I_z = 3475 ± 174 SLUG • FT² (4711 ± 236 kg • m²)

NOTES

1. UPPER FRAME 4.0 IN DIA X 0.25 IN WALL (102 mm DIA X 6 mm WALL) STEEL TUBING (THREE SIDES)
2. LOWER FRAME 6.0 IN DIA X 0.50 IN WALL (152 mm DIA X 13 mm WALL) STEEL TUBING
3. FACE PLATE 0.75 IN (19 mm) THICK COLD ROLLED STEEL
4. LEADING EDGE 1.0 X 4.0 IN (25 X 102 mm) STEEL BAND, SHARP EDGES BROKEN.
5. ALL INNER REINFORCEMENTS 4.0 X 2.0 X 0.19 IN (102 X 51 X 5 mm) STEEL TUBING.

FIG. 2–COMMON CARRIAGE WITH CONTOURED IMPACT SURFACE ATTACHED

tributed so that the weight on each axle as measured at the tire-ground interface is in proportion to its GAWR. If the weight on any axle, when the vehicle is loaded to unloaded vehicle weight plus dummy weight, exceeds the axle's proportional share of the test weight, the remaining weight shall be placed so that the weight on that axle remains the same. Each dummy shall be restrained only by means that are installed in the vehicle for protection at its seating position.

(c) Except as specified in S7.1.1, a school bus with a GVWR greater than 10,000 pounds is loaded to its unloaded vehicle weight plus 120 pounds of unsecured weight at each designated seating position.

S7.2 Lateral moving barrier crash test conditions. The lateral moving barrier crash test conditions are those specified in S8.2 of Standard No. 208, 49 CFR 571.208.

S7.3 Rear moving barrier test conditions. The rear moving barrier test conditions are those specified in S8.2 of Standard No. 208, 49 CFR 571.208, except for the positioning of the barrier and the vehicle. The barrier and test vehicle are positioned so that at impact—

(a) The vehicle is at rest in its normal attitude;

(b) The barrier is traveling at 30 mph with its face perpendicular to the longitudinal centerline of the vehicle; and

(c) A vertical plane through the geometric center of the barrier impact surface and perpendicular to that surface coincides with the longitudinal centerline of the vehicle.

S7.4 Static rollover test conditions. The vehicle is rotated about its longitudinal axis, with the axis kept horizontal, to each successive increment of 90°, 180°, and 270° at a uniform rate, with 90° of rotation taking place in any time interval from 1 to 3 minutes. After reaching each 90° increment the vehicle is held in that position for 5 minutes.

S7.5 Moving contoured barrier test conditions. The following conditions apply to the moving contoured barrier crash test:

S7.5.1. The moving barrier, which is mounted on a carriage as specified in Figure 1, is of rigid construction, symmetrical about a vertical longitudinal plane. The contoured impact surface, which is 24.75 inches high and 78 inches wide, conforms to the dimensions shown in Figure 2, and is attached to the carriage as shown in that figure. The ground clearance to the lower edge of the impact surface is 5.25 ± 0.5 inches. The wheelbase is 120 ± 2 inches.

S7.5.2 The moving contoured barrier, including the impact surface, supporting structure, and carriage, weighs $4{,}000 \pm 50$ pounds with the weight distributed so that 900 ± 25 pounds is at each rear wheel and 1100 ± 25 pounds is at each front wheel. The center of gravity is located 54.0 ± 1.5 inches rearward of the front wheel axis, in the vertical longitudinal plane of symmetry, 15.8 inches above the ground. The moment of inertia about the center of gravity is:

$$I_x = 271 \pm 13.6 \text{ slug ft}^2$$
$$I_z = 3475 \pm 174 \text{ slug ft}^3$$

S7.5.3 The moving contoured barrier has a solid nonsteerable front axle and fixed rear axle attached directly to the frame rails with no spring or other type of suspension system on any wheel. (The moving barrier assembly is equipped with a braking device capable of stopping its motion.)

S7.5.4 The moving barrier assembly is equipped with G78–15 pneumatic tires with a tread width of 6.0 ± 1 inch, inflated to 24 psi.

S7.5.5 The concrete surface upon which the vehicle is tested is level, rigid, and of uniform construction, with a skid number of 75 when measured in accordance with American Society of Testing and Materials Method E-274-65T at 40 mph, omitting water delivery as specified in paragraph 7.1 of that method.

S7.5.6 The barrier assembly is released from the guidance mechanism immediately prior to impact with the vehicle.

38 F.R. 22397
August 20, 1973

40 F.R. 48352
October 15, 1975

MOTOR VEHICLE SAFETY STANDARD NO. 302

Flammability of Interior Materials—Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses

(Docket No. 3–3; Notice 4)

This notice amends § 575.21 of Title 49 of the Code of Federal Regulations by adding a new motor vehicle safety standard, No. 302, Flammability of Interior Materials. Notices of proposed rulemaking on the subject were published on December 31, 1969 (34 F.R. 20434) and June 26, 1970 (35 F.R. 10460).

As stated in the notice of December 31, 1969, the occurrence of thousands of fires per year that begin in vehicle interiors provide ample justification for a safety standard on flammability of interior materials. Although the qualities of interior materials cannot by themselves make occupants safe from the hazards of fuel-fed fires, it is important, when fires occur in the interior of the vehicle from such sources as matches, cigarettes, or short circuits in interior wiring, that there be sufficient time for the driver to stop the vehicle, and if necessary for occupants to leave it, before injury occurs.

The question on which the public responses to the above notices differed most widely was the burn rate limit to be required. The rate proposed was 4 inches per minute, measured by a horizontal test. Some manufacturers suggested maximum burn rates as high as 15 inches per minute. The Center for Auto Safety, the Textile Fibers and By-Products Association, and the National Cotton Batting Institute, on the other hand, suggested essentially a zero burn rate, or self-extinguishment, requirement, with a vertical rather than a horizontal test. A careful study was made of the available information on this subject, including the burn rates of materials currently in use or available for use, recommendations or regulations of other agencies, and the economic and technical consequences of various possible rate levels and types of tests. A considerable amount of Bureau-sponsored research has been conducted and is continuing on the subject. On consideration of this data, the Bureau has decided to retain the 4-inch-per-minute burn limit, with the horizontal test, in this standard. It has been determined that suitable materials are not available in sufficient quantities, at reasonable costs, to meet a significantly more stringent burn rate by the effective date that is hereby established. The 4-inch rate will require a major upgrading of materials used in many areas, and a corresponding improvement in this aspect of motor vehicle safety. It is important that this standard not hinder manufacturers' efforts to comply with the crash protection requirements that are currently being imposed, and that in the Bureau's judgment are of the greatest importance. Further study will be made, however, of the feasibility of, and justification for, imposing more stringent requirements with a later effective date.

As pointed out in several comments, the problem of toxic combustion by-products is closely related to that of burn rate. Release of toxic gases is one of the injury-producing aspects of motor vehicle fires, and many of the common ways of treating materials to reduce their burn rates involve chemicals that produce highly poisonous gases such as hydrogen chloride and hydrogen cyanide. The problem of setting standards with regard to combustion by-products is difficult and complex, and the subject of continuing research under Bureau auspices. Until enough is known in this area to form the basis for a standard, and to establish the proper interaction between burn rate and toxicity, this uncertainty constitutes an additional reason for not requiring self-extinguishing materials.

The proposal specified a particular commercial gas for the test burn and several comments suggested problems in obtaining the gas for manufacture testing. As is the case with all the motor vehicle safety standards, the test procedures describe the tests that the regulated vehicles or equipment must be capable of passing, when tested by the Bureau, and not the method by which a manufacturer must ascertain that capability. Any gas with at least as high a flame temperature as the gas described in the standard would therefore be suitable for manufacturer testing. To make this point clearer, and to use a more readily available reference point, the standards been reworded to specify a gas that "has a flame temperature equivalent to that of natural gas."

The dimensions of the enclosure within which the test is conducted have been changed from those proposed, in order to provide more draft-free conditions, and consequently more repeatable results. Smaller cabinets, furthermore, evidently are more generally available than larger ones. Again it should be noted that there is no necessity that manufacturers duplicate the dimensions of the test cabinet, as long as they can establish a reasonable basis for concluding that their materials will meet the requirements when tested in such a cabinet.

Several comments questioned the need for specifying the temperature and relative humidity under which the material is conditioned and the test is conducted. The foregoing discussions of the relation of the standard to manufacturer testing apply here also. The specification of temperature and relative humidity for conditioning and testing is made to preclude any arguments, in the face of a compliance test failure, that variations in test results are due to permitted variations in test conditions. The relative humidity specification has been changed from 65 percent, as proposed, to 50 percent. This humidity level represents more closely the conditions encountered in use during fairly dry weather. While it is a slightly more stringent condition, it is one in wide use for materials testing, according to the comments, and is not, in the judgment of the Bureau, a large enough change in the substance of the proposal to warrant further notice and opportunity for comment.

Several comments suggested that the standard should specify the number of specimens to be tested, with averaging of results, as is commonly found in specification-type standards. The legal nature of the motor vehicle safety standards is such, however, that sampling and averaging provisions would be inappropriate. As defined by the National Traffic and Motor Vehicle Safety Act, the standards are minimum performance levels that must be met by every motor vehicle or item of motor vehicle equipment to which they apply. Enforcement is based on independent Bureau testing, not review of manufacturer testing, and manufacturers are required to take legal responsibility for every item they produce. The result, and the intent of the Bureau in setting the standards, is that manufacturers must establish a sufficient margin of performance between their test results and the standard's requirements to allow for whatever variances may occur between items tested and items produced.

The description of portions to be tested has been changed slightly, such that the surface and the underlying materials are tested either separately or as a composite, depending on whether they are attached to each other as used in the vehicle. In the proposal, surface and underlying materials were to be tested separately regardless of how used, an element of complexity found unnecessary for safety purposes.

In response to comments with respect to materials that burn at a decreasing rate, to which the application of the test is not clear, an additional criterion has been added. If material stops burning before it has burned for 60 seconds, and does not burn more than 2 inches, it is considered to meet the requirement.

In consideration of the foregoing, § 571.21 of Title 49, Code of Federal Regulations, is amended by the addition of Standard No. 302, Flammability of Interior Materials.

Effective date: September 1, 1972. Because of the extensive design changes that will be necessitated by this new standard, and the lead-time consequently required by manufacturers to prepare for production, it is found, for good

cause shown, that an effective date later than one year from the issuance of this notice is in the public interest.

Issued on December 29, 1970.

Douglas W. Toms
Director

36 F.R. 289
January 8, 1971

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 302

Flammability of Interior Materials

(Docket No. 3–3; Notice 7b)

This notice modifies the test procedures and specimen preparation requirements of Motor Vehicle Safety Standard No. 302, *Flammability of interior materials* (49 CFR 571.302). A notice of proposed rulemaking was issued on May 17, 1973 (38 FR 12934).

Several comments on the notice of proposed rulemaking suggested exempting small components on the basis of size because of the confusion caused by paragraph S4.1. This agency has not found, however, that the exemption of a component on the basis of size is consistent with safety. Rather, NHTSA finds that if a component is too small to produce an acceptable test sample, a test sample consisting of the material from which the component is fabricated should be substituted. Consequently, a new section S4.1.1 has been added to require surrogate testing of such components as switches, knobs, gaskets, and grommets which are considered too small to be effectively tested under the current procedures.

A previous notice of proposed rulemaking (36 FR 9565) suggested a scheme for testing single and composite materials that would allow the testing of certain configurations of vehicle interior materials not taken into account under the present scheme. Examples of such configurations are multi-layered composites and single layers of underlying materials that are neither padding nor cushioning materials. Comments to that notice argued that some aspects of the proposed scheme would require some duplicative testing without providing a measurable safety benefit.

In response to these arguments, it was proposed (38 F.R. 12934) that S4.2 be amended to take into account some omissions in the present scheme and to reduce the complexity of testing single and composite materials. After reviewing the comments, the proposed scheme is adopted. Thus, the standard is amended to require single materials or composites (materials that adhere at every point of contact), any part of which is within ½ inch of the surface of the component, to meet the burn-rate requirements. Materials that are not part of adhering composites are subject to the requirements when tested separately. Those materials that do adhere to adjacent materials at every point of contact are subject to the requirements as composites when tested with the adjacent materials. The concept of "adherence" would replace language presently contained in the standard describing materials as "bonded, sewed, or mechanically attached." An illustrative example is included in the text of the section.

Several comments in response to the notice of proposed rulemaking requested changes in the test cabinet, as did comments in response to previous notices concerning this standard. The NHTSA has evaluated various recommendations and suggestions concerning the cabinet. No changes are proposed in this notice, however, as sufficient justification has not been found for a design change at this time.

Paragraph S5.2.1 of the standard presently provides that materials exceeding ½ inch in thickness are to be cut down to ½ inch in thickness before testing. As described in the notice of proposed rulemaking, cutting certain materials to the prescribed thickness produces a tufted surface upon which a flame front may be propagated at a faster rate than it would be upon the surface of the material before cutting, thereby creating an artificial test condition. In order

to avoid this, the requirements for the transmission rate of a flame front are amended in S4.3(a) to exclude surfaces created by cutting.

The notice of proposed rulemaking points out that a related problem has arisen concerning which surfaces of a test specimen should face the flame in the test cabinet. To answer this question and avoid unnecessary test duplication, the test procedures are amended to provide that the surface of the specimen closest to the occupant compartment air space face downward on the test frame. The test specimen is produced by cutting the material in the direction that provides the most adverse test results.

In light of the above, Motor Vehicle Safety Standard No. 302, 49 CFR § 571.302, is amended. . . .

Effective date: Oct. 1, 1975.

(Secs. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.51.)

Issued on March 17, 1975.

James B. Gregory
Administrator

40 F.R. 14318
March 31, 1975

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 302

Flammability of Interior Materials

(Docket No. 3–3; Notice 9)

On March 31, 1975, the National Highway Traffic Safety Administration (NHTSA) issued a notice modifying the test procedures and specimen preparation requirements of Motor Vehicle Safety Standard No. 302, 49 CFR 571.302, *Flammability of interior materials* (40 FR 14318). Petitions for reconsideration of the rule were received from American Motors Corporation, General Motors Corporation, White Motor Corporation, Chrysler Corporation, Volkswagen of America, Inc., Toyota Motor Sales, U.S.A., Inc., Ford Motor Company, and the Motor Vehicle Manufacturers Association of the United States, Inc.

The NHTSA notice established a process of surrogate testing for components which were too small to test without difficulty using the procedures previously prescribed by Standard No. 302. The objections raised to this new process by the petitioners were that (a) the surrogate testing procedure is an entirely new departure, and the public should have been afforded an opportunity for comment, (b) the results of surrogate testing will in certain cases differ from the results of testing the actual component, (c) the creation of a surrogate testing sample of certain materials, such as elastic cord, is impossible, and (d) the dimensions of the surrogate sample are inappropriate.

It should be fully understood that small components which would otherwise be included within the purview of Standard No. 302 are not excluded by virtue of their size. Further, the NHTSA intends to utilize a surrogate testing procedure, among other testing procedures, in the case of small components as the first step in determining whether a safety defect exists pursuant to section 152 of the National Traffic and Motor Vehicle Safety Act. Since the testing of small components is a more difficult process, the NHTSA concluded in amending Standard No. 302 to include the surrogate testing process that the new requirement was less stringent than that currently required by the standard. Further, by amending the standard the industry could also be fully apprised of one of the methods the NHTSA intended to use to determine whether a section 152 defect existed.

Nonetheless, it appears from the petitions for reconsideration which were received that a number of manufacturers feel that they should be allowed an opportunity for comment. The NHTSA concludes their request is reasonable and the rule, as it relates to surrogate testing, is hereby revoked and is reissued as a notice of proposed rulemaking in this issue of the FEDERAL REGISTER.

A number of the petitioners questioned the need for including any small components within the ambit of Standard No. 302, citing the notice of proposed rulemaking (38 FR 12934, May 17, 1973) which stated that certain small components designed to absorb energy are not fire hazards. Therefore, the petitioners believe the NHTSA has reversed its previous position.

This understanding is correct. As the NHTSA said in the preamble to the proposed amendment to Standard No. 302, issued concurrently with the amendment to the Standard (March 31, 1975, 40 FR 14340):

> On May 11, 1973, the NHTSA issued a notice (38 FR 12934) which proposed, inter alia, amending paragraph S4.1 of Standard No. 302 to enumerate the interior components of vehicle occupant compartment which fell within the ambit of the standard.

* * * * * *

Comments to the notice, however, have made clear that the enumeration of components, even with the proposed amendment, will continue to confuse manufacturers required to meet the standard.

* * * * * *

While some materials exposed to the occupant compartment air space are not fire hazards, the burden of ascertaining that fact should properly lie with the manufacturer.

Several petitions also questioned what safety benefits would come from applying the standard to small components. As petitioner American Motors pointed out, the purpose of Standard No. 302 is to provide sufficient time for the occupants of a vehicle to exit in case of an interior fire. Thus, even small components which are highly flammable would hasten the spreading of fires in motor vehicles, resulting in a serious hazard.

Testing procedures. Petitioners pointed out that while the preamble provides that the surface of the specimen closest to the occupant compartment air space face downward on test frame, this is not made entirely clear in the body of the standard itself. The standard is amended to clarify this matter. Likewise, a definition of the term "occupant compartment air space" is added, although this term was used in the notice of proposed rulemaking without raising a problem for those commenting.

Extension of effective date of amendment. Several petitioners asked for an extension of the effective date. As the surrogate testing procedures have been revoked and reissued as a proposed rule, the NHTSA concludes that an extension of the effective date is not necessary.

Redesignation of Docket 3–3; Notice 7. Through a clerical error, two notices were issued with the heading, "Docket 3–3; Notice 7" (July 11, 1973, 38 FR 18564; March 31, 1975, 40 FR 14318). The notice appearing at 38 FR 18564 is hereby redesignated "Notice 7a" and that appearing at 49 FR 14318 is redesignated "Notice 7b."

In consideration of the foregoing, Motor Vehicle Safety Standard No. 302, 49 CFR 571.302, is amended. . . .

Effective date: September 16, 1975.

Because this amendment relieves a restriction, it is found for good cause shown that an immediate effective date is in the public interest.

(Secs. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.51.)

Issued on September 10, 1975.

James B. Gregory
Administrator

September 16, 1975
40 F.R. 42746

PREAMBLE TO AMENDMENT TO MOTOR VEHICLE SAFETY STANDARD NO. 302

Flammability of Interior Materials

(Docket No. 3–3; Notice 11)

This notice establishes a new section, S3A. *Definitions*, in Motor Vehicle Safety Standard No. 302, 49 CFR 571.302.

On September 16, 1975, the NHTSA published in the Federal Register its response to a petition for reconsideration of Motor Vehicle Safety Standard No. 302, *Flammability of interior materials* (40 FR 42746). The rule established a definition of the term "occupant compartment air space" that was supposed to be added to "S3A. *Definitions*." The wording of the amendment was faulty, however, since the Definitions section had not yet been established in Standard No. 302. This notice corrects the error by adding that section to the standard.

Petitions have been received from General Motors Corporation, Motor Vehicle Manufacturers Association, American Motors Corporation, and Ford Motor Company requesting that the definition of "occupant compartment air space" in Notice 9 be revoked. These petitions will be addressed in a separate notice. The purpose of this notice is only to promulgate the section heading which was omitted in error from Notice 9.

In light of the above, in place of the amendment numbered 1. in Docket 3–3, Notice 9 (40 FR 42746, September 16, 1975), Motor Vehicle Safety Standard No. 302 is amended by adding a new S3A. *Definitions*. . . .

Effective date: December 4, 1975. Because this amendment is of an interpretative nature and makes no substantive change in the rule, it is found for good cause shown that an immediate effective date is in the public interest.

(Sec. 103, 119 Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at CFR 1.51)

Issued on November 28, 1975.

James B. Gregory
Administrator

40 F.R. 56667
December 4, 1975

MOTOR VEHICLE SAFETY STANDARD NO. 302

Flammability of Interior Materials—Passenger Cars, Multipurpose Passenger Vehicles, Trucks, and Buses

(Docket N. 3-3; Notice 4)

S1. Scope. This standard specifies burn resistance requirements for materials used in the occupant compartments of motor vehicles.

S2. Purpose. The purpose of this standard is to reduce the deaths and injuries to motor vehicle occupants caused by vehicle fires, especially those originating in the interior of the vehicle from sources such as matches or cigarettes.

S3. Application. This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

S3A. Definitions.

"Occupant compartment air space" means the space within the occupant compartment that normally contains refreshable air. (40 F.R. 42746—September 16, 1975. Effective 9/16/75. 40 F.R. 56667—December 4, 1975. Effective: 12/4/75)

S4. Requirements.

S4.1 The portions described in S4.2 of the following components of vehicle occupant compartments shall meet the requirements of S4.3: Seat cushions, seat backs, seat belts, headlining, convertible tops, arm rests, all trim panels including door, front, rear, and side panels, compartment shelves, head restraints, floor coverings, sun visors, curtains, shades, wheel housing covers, engine compartment covers, mattress covers, and any other interior materials, including padding and crash-deployed elements, that are designed to absorb energy on contact by occupants in the event of a crash.

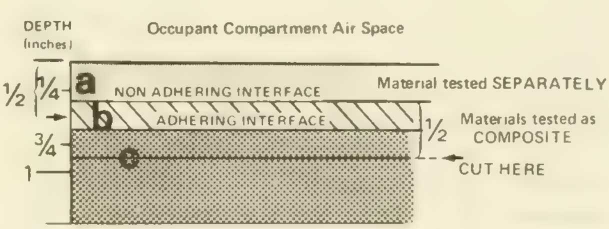
S4.1.1 Deleted and Reserved.

S4.2 Any portion of a single or composite material which is within ½ inch of the occupant compartment air space shall meet the requirements of S4.3.

S4.2.1 Any material that does not adhere to other material(s) at every point of contact shall meet the requirements of S4.3 when tested separately.

S4.2.2 Any material that adheres to other material(s) at every point of contact shall meet the requirements of S4.3 when tested as a composite with the other material(s). Material A has a non-adhering interface with material B and is tested separately. Part of material B is within ½ inch of the occupant compartment air space, and materials B and C adhere at every point of contact; therefore B and C are tested as a composite. The cut is in material C as shown, to make a specimen ½ inch thick.

Illustrative Example



S4.3(a) When tested in accordance with S5, material described in S4.1 and S4.2 shall not burn, nor transmit a flame front across its surface, at a rate of more than 4 inches per minute.

However, the requirement concerning transmission of a flame front shall not apply to a surface created by the cutting of a test specimen for purposes of testing pursuant to S5.

(b) If a material stops burning before it has burned for 60 seconds from the start of timing, and has not burned more than 2 inches from the point where timing was started, it shall be considered to meet the burn-rate requirement of S4.3(a).

S5. Test procedure.

S5.1 Conditions.

S5.1.1 The test is conducted in a metal cabinet for protecting the test specimens from drafts. The interior of the cabinet is 15 inches long, 8 inches deep, and 14 inches high. It has a glass observation window in the front, a closable opening to permit insertion of the specimen holder, and a hole to accommodate tubing for a gas burner. For ventilation, it has a ½-inch clearance space around the top of the cabinet, ten ¾-inch-diameter holes in the base of the cabinet, and legs to elevate the bottom of the cabinet by three-eighths of an inch, all located as shown in Figure 1.

S5.1.2 Prior to testing, each specimen is conditioned for 24 hours at a temperature of 70° F. and a relative humidity of 50 percent, and the test is conducted under those ambient conditions.

S5.1.3 The test specimen is inserted between two matching U-shaped frames of metal stock 1 inch wide and three-eighths of an inch high. The interior dimensions of the U-shaped frames are 2 inches wide by 13 inches long. A specimen that softens and bends at the flaming end so as to cause erratic burning is kept horizontal by supports consisting of thin, heat resistant wires, spanning the width of the U-shaped frame under the specimen at 1-inch intervals. A device that may be used for supporting this type of material is an additional U-shaped frame, wider than the U-shaped frame containing the specimen, spanned by 10-mil wires of heat-resistant composition at 1-inch intervals, inserted over the bottom U-shaped frame.

S5.1.4 A bunsen burner with a tube of ⅜-inch inside diameter is used. The gas adjusting valve is set to provide a flame, with the tube vertical, of 1½ inches in height. The air inlet to the burner is closed.

S5.1.5 The gas supplied to the burner has a flame temperature equivalent to that of natural gas.

S5.2 Preparation of specimens.

S5.2.1 Each specimen of material to be tested shall be a rectangle 4 inches wide by 14 inches long, wherever possible. The thickness of the specimen is that of the single or composite material used in the vehicle, except that if the material's thickness exceeds ½ inch, the specimen is cut down to that thickness measured from the surface of the specimen closest to the occupant compartment air space. Where it is not possible to obtain a flat specimen because of surface curvature, the specimen is cut to not more than ½ inch in thickness at any point. The maximum available length or width of a specimen is used where either dimension is less than 14 inches or 4 inches, respectively, unless surrogate testing is required under S4.1.1.

S5.2.2 The specimen is produced by cutting the material in the direction that provides the most adverse test results. The specimen is oriented so that the surface closest to the occupant compartment air space faces downward on the test frame.

S5.2.3 Material with a napped or tufted surface is placed on a flat surface and combed twice against the nap with a comb having seven to eight smooth, rounded teeth per inch.

S5.3 Procedure.

(a) Mount the specimen so that both sides and one end are held by the U-shaped frame, and one end is even with the open end of the frame. Where the maximum available width of a specimen is not more than 2 inches, so that the sides of the specimen cannot be held in the U-shaped frame, place the specimen in position on wire supports as described in S5.1.3, with one end held by the closed end of the U-shaped frame.

(b) Place the mounted specimen in a horizontal position, in the center of the cabinet.

(c) With the flame adjusted according to S5.1.4, position the bunsen burner and specimen so that the center of the burner tip is three-fourths of an inch below the center of the bottom edge of the open end of the specimen.

(d) Expose the specimen to the flame for 15 seconds.

(e) Begin timing (without reference to the period of application of the burner flame) when the flame from the burning specimen reaches a point 1½ inches from the open end of the specimen.

(f) Measure the time that it takes the flame to progress to a point 1½ inches from the clamped end of the specimen. If the flame does not reach the specified end point, time its progress to the point where flaming stops.

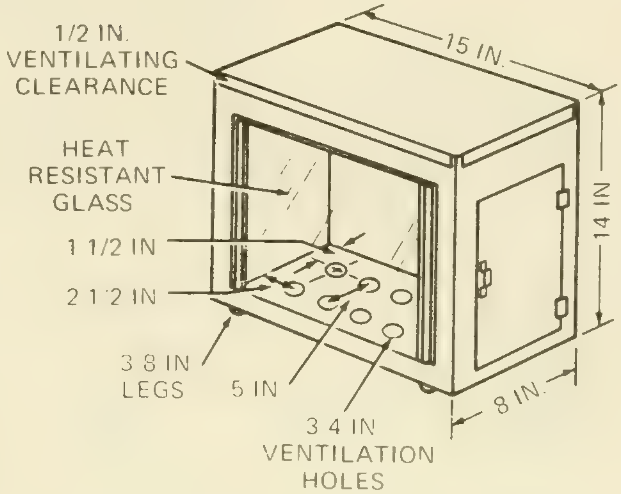
(g) Calculate the burn rate from the formula

$$B = 60 \times \frac{D}{T}$$

Where B = burn rate in inches per minute,

D = length the flame travels in inches, and

T = time in seconds for the flame to travel D inches.



36 F.R. 289
January 8, 1971

MOTOR VEHICLE SAFETY STANDARDS
Notice of Ruling Regarding Chassis-Cabs

Inquiry has been received from persons engaged in the sale of trucks, buses, and multipurpose vehicles regarding their legal responsibility under the National Traffic and Motor Vehicle Safety Act of 1966 for assuring that vehicles sold by them are in conformity with all applicable motor vehicle safety standards. Such persons commonly purchase chassis-cabs from manufacturers and bodies or work-performing and load-carrying structures from other manufacturers and then combine the chassis-cab with the body or other structure. A regulation is being issued this date by the Federal Highway Administration defining the chassis-cab as a vehicle within the meaning of the Act, requiring that it meet all motor vehicle safety standards applicable on the date of manufacture of the chassis-cab.[1] Under this regulation the manufacturer of a chassis-cab manufactured subsequent to January 1, 1968, will have responsibility for compliance with all applicable motor vehicle safety standards as set forth therein and for certification of such compliance to distributors and dealers.

Section 101(5) of the National Traffic and Motor Vehicle Safety Act defines a "manufacturer" as any person engaged in the "assembling" of motor vehicles. Persons who combine chassis-cabs with bodies or similar structures are, therefore, manufacturers within the meaning of the Act. Inasmuch as the chassis-cab's manufacturer is responsible for compliance with standards under the regulation issued today, persons who add bodies or other structures to such chassis-cab are not considered manufacturers of the chassis-cab and, therefore, will not be responsible for the conformance of the chassis-cab to the standards certified by the manufacturer of the chassis-cab. In numerous instances the chassis-cab will not be capable of complying with motor vehicle safety standard 108 because it will not be equipped with all items of lighting equipment referred to in such standard. Where vendors combine a chassis-cab which has not been certified to be in conformance with standard 108, with a body or other like structure, such vendor will be responsible for compliance with the lighting standard, and where such vendor sells the combined assemblage to another vendor, certification of compliance with the lighting standard must accompany the vehicle.

We are advised that a substantial inventory of chassis-cabs manufactured prior to the effective date of the initial motor vehicle safety standards and hence not required to comply with the same will be held by manufacturers, distributors, and dealers on January 1, 1968. These vehicles may contain various items of lighting equipment manufactured prior to the effective date of the lighting standard or be designed to accept such equipment. Under these circumstances, it does not appear appropriate to require compliance with the lighting standard when such chassis-cabs, i.e., those manufactured prior to January 1, 1968, are combined with bodies or similar strucutres. Section 108(a)(1) of the Act also prohibits any person from manufacturing for sale or selling any motor vehicle manufactured "after the date any applicable Federal motor vehicle safety standard takes effect under this title unless it is in conformity with such standard ***." Under this provision persons who combine the chassis-cab with a body or other structure will be responsible for (1) compliance of the combined assemblage with any motor vehicle safety standard applicable to the end use of the combined assemblage in effect on the date of manufacture of the chassis-cab, compliance with which has not already been certified

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[1] See F.R. Doc. 67-15174, Title 23, in Rules and Regulations Section, supra.

MOTOR VEHICLE SAFETY STANDARDS
Notice of Ruling Regarding Chassis-Cabs

Inquiry has been received from persons engaged in the sale of trucks, buses, and multipurpose vehicles regarding their legal responsibility under the National Traffic and Motor Vehicle Safety Act of 1966 for assuring that vehicles sold by them are in conformity with all applicable motor vehicle safety standards. Such persons commonly purchase chassis-cabs from manufacturers and bodies or work-performing and load-carrying structures from other manufacturers and then combine the chassis-cab with the body or other structure. A regulation is being issued this date by the Federal Highway Administration defining the chassis-cab as a vehicle within the meaning of the Act, requiring that it meet all motor vehicle safety standards applicable on the date of manufacture of the chassis-cab.[1] Under this regulation the manufacturer of a chassis-cab manufactured subsequent to January 1, 1968, will have responsibility for compliance with all applicable motor vehicle safety standards as set forth therein and for certification of such compliance to distributors and dealers.

Section 101(5) of the National Traffic and Motor Vehicle Safety Act defines a "manufacturer" as any person engaged in the "assembling" of motor vehicles. Persons who combine chassis-cabs with bodies or similar structures are, therefore, manufacturers within the meaning of the Act. Inasmuch as the chassis-cab's manufacturer is responsible for compliance with standards under the regulation issued today, persons who add bodies or other structures to such chassis-cab are not considered manufacturers of the chassis-cab and, therefore, will not be responsible for the conformance of the chassis-cab to the standards certified by the manufacturer of the chassis-cab. In numerous instances the chassis-cab will not be capable of complying with motor vehicle safety standard 108 because it will not be equipped with all items of lighting equipment referred to in such standard. Where vendors combine a chassis-cab which has not been certified to be in conformance with standard 108, with a body or other like structure, such vendor will be responsible for compliance with the lighting standard, and where such vendor sells the combined assemblage to another vendor, certification of compliance with the lighting standard must accompany the vehicle.

We are advised that a substantial inventory of chassis-cabs manufactured prior to the effective date of the initial motor vehicle safety standards and hence not required to comply with the same will be held by manufacturers, distributors, and dealers on January 1, 1968. These vehicles may contain various items of lighting equipment manufactured prior to the effective date of the lighting standard or be designed to accept such equipment. Under these circumstances, it does not appear appropriate to require compliance with the lighting standard when such chassis-cabs, i.e., those manufactured prior to January 1, 1968, are combined with bodies or similar strucutres. Section 108(a)(1) of the Act also prohibits any person from manufacturing for sale or selling any motor vehicle manufactured "after the date any applicable Federal motor vehicle safety standard takes effect under this title unless it is in conformity with such standard ***." Under this provision persons who combine the chassis-cab with a body or other structure will be responsible for (1) compliance of the combined assemblage with any motor vehicle safety standard applicable to the end use of the combined assemblage in effect on the date of manufacture of the chassis-cab, compliance with which has not already been certified

[1] See F.R. Doc. 67-15174, Title 23, in Rules and Regulations Section, supra.

by the chassis-cab manufacturer, and (2) compliance with all applicable standards in effect on the date of manufacturer of the chassis-cab to the extent that the addition of a body or other structure to the chassis-cab affects the chassis-cab's previous conformance with applicable standards.

To insure that the person combining the chassis-cab with the body or other structure has adequate information to enable him to meet the conditions specified above, the regulation being issued concurrently with this ruling requires the chassis-cab manufacturer to affix a label to the chassis-cab which identifies the Federal motor vehicle safety standards with which the chassis-cab fully complies for the principal end uses of such chassis-cab.

Issued in Washington, D.C., on December 29, 1967.

Lowell K. Bridwell,
Federal Highway Administrator

33 F.R. 29
January 3, 1968

FEDERAL MOTOR VEHICLE SAFETY STANDARDS
(FHWA Ruling 68-1)

Notice of Ruling Regarding Campers Slide-in and Chassis-Mount

This ruling is in response to inquiries for a clarification of the applicability of Federal Motor vehicle safety standards to certain items of motor vehicle equipment commonly known as "campers" which are used mostly for recreational purposes.

A "camper" can be described generally as a portable structure designed to be loaded onto, or affixed to, a motor vehicle to provide temporary living quarters for recreation, travel, or other use. The ruling is concerned with two general categories of campers. The first, a "slide-in camper", is placed on, or slides onto a completed vehicle, usually a pickup truck. The second, a "chassis-mount camper", is mounted on a chassis-cab.

In past months the Bureau received a number of written inquiries regarding the applicability of the glazing material standard (No. 205) to slide-in campers. These persons received responses from the Bureau indicating that slide-in campers would have to comply with standard 205 under certain specified conditions. These responses of the Bureau apparently received widespread dissemination in the industry. Subsequently, additional inquiries were received from affected persons asking for clarification of the Bureau's earlier responses with respect to the question of whether standard 205 was applicable to glazing materials contained in slide-in campers sold by the manufacturer of such campers to members of the public and to dealers when not an integral part of the vehicle.

The Bureau has reconsidered this question and determined that the glazing standard is applicable to slide-in campers.

Standard 205 is applicable to "glazing materials for use in passenger cars, multipurpose passenger vehicles, motorcycles, trucks and buses." The slide-in camper is an item of motor vehicle equipment for use in motor vehicles. As such, glazing materials contained in slide-in campers must comply with standard 205 when such campers are sold as a separate unit as well as when attached to a completed pickup truck. Additionally, manufacturers of slide-in campers must also comply with the certification requirements set forth in section 114 of the National Traffic and Motor Vehicle Safety Act of 1966 (15 U.S.C. 1403).

Review of the Bureau's prior communications with affected persons indicates that such persons, and others who received notice of such communications, could justifiably have concluded that standard 205 was subject to an interpretation which excluded its application to slide-in campers sold directly to consumers or to dealers when not an integral part of the pickup truck. In these circumstances the Bureau does not regard it as appropriate that the interpretation of the applicability of standard 205, which this ruling announces, should be given retroactive effect. Further, in view of such reliance a reasonable time should be afforded affected parties to allow for possible necessary production adjustments. Accordingly, it is determined that with respect to slide-in campers, the interpretation announced by this ruling shall not become effective until July 1, 1968.

With regard to the chassis-mount camper, it is an integral part of the vehicle when attached to a chassis-cab as defined in § 371.3(b), Part 371, Federal Motor Vehicle Safety Standards (33 F.R. 19).

Persons who mount the chassis-mount camper to the chassis-cab are manufacturers of vehicles within the meaning of section 102(3) of the National Traffic and Motor Vehicle Safety Act

of 1966 (15 U.S.C. 1392). As such, they are to be guided by the regulation and ruling on chassis-cabs issued December 29, 1967 (33 F.R. 19 and 33 F.R. 29). Under this regulation and ruling persons combining a chassis-cab manufactured on or after January 1, 1968, with a body or like structure (in this case the chassis-mount camper) are responsible for assuring that the completed assemblage complies with all applicable standards in effect on the date of manufacture of the chassis-cab which had not previously been met by the manufacturer of the chassis-cab, and for assuring that previously met standards have not been adversely affected by the addition of the chassis-mount camper.

Issued in Washington, D.C., on March 20, 1968.

Lowell K. Bridwell,
Federal Highway Administrator

33 F.R. 5020
March 26, 1968

PREAMBLE TO PART 573—DEFECT REPORTS

(Docket No. 69–31; Notice No. 2)

On December 24, 1969, a notice of proposed rulemaking entitled, "Defect Reports", was published in the *Federal Register* (34 F.R. 20212). The notice proposed requirements for reports and information regarding defects in motor vehicles, to be submitted to the National Highway Traffic Safety Administration by manufacturers of motor vehicles pursuant to sections 112, 113, and 119 of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1401, 1402, and 1407).

The notice requested comments on the proposed requirements. All comments received have been considered and some are discussed below.

Several comments asked whether both the fabricating manufacturer and the importer of imported vehicles were required to comply with all the proposed requirements. A similar question was asked in regard to manufacturers of incomplete vehicles and subsequent manufacturers of the same vehicles. In response to the comments, § 573.3 provides that in the case of imported vehicles, compliance by either the fabricating manufacturer or the importer of the imported vehicle with §§ 573.4 and 573.5 of this part, with respect to a particular defect, shall be considered compliance by both. In the case of vehicles manufactured in two or more stages, compliance by either the manufacturer of the incomplete vehicle or one of the subsequent manufacturers of the vehicle with §§ 573.4 and 573.5 of this part, with respect to a particular defect, shall be considered compliance by both the incomplete vehicle manufacturer and the subsequent manufacturers.

Many comments requested that the time for the initial filing of the direct information report be increased to allow opportunity for the extensive and complex testing often necessary to determine whether a defect is safety-related. As proposed, the time for initially filing the report was within 5 days after the discovery of a defect that the manufacturer subsequently determined to be safety-related. In response to these comments, § 573.4(b) provides that the report shall be submitted by the manufacturer not more than 5 days after he or the Administrator has determined that a defect in the manufacturer's vehicles relates to motor vehicle safety.

Several comments requested the deletion of one or more items of information proposed for inclusion in the defect information report. Objections to providing an evaluation of the risk of accident due to the defect, a list of all incidents related to the defect, and an analysis of the cause of the defect were based on the ground that the information would be inherently speculative. The proposed requirements for these three items of information have been deleted. In place of the list of incidents, § 573.4(c)(6) requires a chronology of all principal events that were the basis for the determination of the existence of a safety-related defect. In accordance with the deletion of the list of incidents, the provision in the proposal requiring quarterly reports to contain information concerning previously unreported incidents has also been deleted.

Several comments stated that the requirement in the proposal for the submission of a copy of all communications sent to dealers and purchasers concerning a safety-related defect would create an unreasonable burden on the manufacturers. The comments reported that the manufacturers would be required to submit to the Administration a large volume of useless correspondence between the manufacturers and individual dealers or purchasers. To mitigate this problem, § 573.4(c)(8) provides that the manufacturers shall submit to the Administration only those communications that are sent to more

than one dealer or purchaser. For the same reason, the requirement in § 573.7 that a manufacturer submit a copy of all communications, other than those required under § 573.4(c)(8), regarding any defect, whether or not safety-related, in his vehicles, is also limited to communications sent to more than one person.

Many comments requested that a regular schedule for submitting quarterly reports be established. They suggested that this be accomplished by requiring that the first quarter for submitting a quarterly report with respect to a particular defect be the calendar quarter in which the defect information report for the defect is initially submitted. As proposed, the first quarter began on the date on which the defect information report was initially submitted. Several of these comments also objected to the proposed requirements for submitting both quarterly reports and annual defect summaries on the ground that the latter would be partially redundant. In response to these comments, the proposed requirement for filing a separate series of quarterly reports for each defect notification campaign has been deleted. Instead, § 573.5(a) requires that each manufacturer submit a quarterly report not more than 25 working days after the close of each calendar quarter. The information specified in § 573.5(c) is required to be provided with respect to each notification campaign, beginning with the quarter in which the campaign was initiated. Unless otherwise directed by the Administration, the information for each campaign is to be included in the quarterly reports for six consecutive quarters or until corrective action has been completed on all defective vehicles involved in the campaign, whichever occurs sooner.

The proposed requirement for filing annual summaries has been deleted. Instead, § 573.5(d) requires that the figures provided in the quarterly reports under paragraph (c) (5), (6), (7), and (8) of § 573.5 be cumulative. In addition, § 573.5(b) requires that each quarterly report contain the total number of vehicles produced during the quarter for which the report is submitted.

Several changes have been made for the purpose of clarification, § 573.4(c)(8) requires that manufacturers submit three copies of the communications specified in that section. In response to questions concerning the use of computers for maintaining owner lists, a reference to computer information storage devices and card files has been added to § 573.6 to indicate that they are suitable. A reference to first purchasers and subsequent purchasers to whom a warranty has been transferred, and any other owners known to the manufacturer, has been added to the same section to make clear that the owner list is required to include both types of purchasers as well as other known owners.

Effective date: October 1, 1971.

Issued on February 10, 1971.

Douglas W. Toms,
Acting Administrator, National Highway Traffic Safety Administration.

36 F.R. 3064
February 17, 1971

PREAMBLE TO AMENDMENT TO PART 573—DEFECT REPORTS

(Docket No. 69–31; Notice 5)

This notice amends the Defect Reports regulation (49 CFR Part 573) to require manufacturers to submit vehicle identification numbers as part of the information furnished by them to the NHTSA. A notice of proposed rulemaking regarding this subject was published November 7, 1972 (37 F.R. 23650).

The purpose of including VIN's in defect reports would be to improve the notification of owners of vehicles involved in safety defect notification campaigns. The State Farm Insurance Company had suggested, for example, that insurance companies could use VIN's to identify vehicles which they insure, and to themselves notify owners of record. The Center for Auto Safety also requested the inclusion of VIN's in defect reports, so it could more readily inform persons who inquire whether particular vehicles were subject to campaigns. Other possible uses, it was noted, would be that State and local inspection facilities could determine, as part of inspection programs, whether particular vehicles had been subjected to campaigns, and if so, whether they had been repaired.

The proposal would have required the submission in the "defect information report" (§ 573.4), within five days of the defect determination, of the vehicle identification number for each vehicle potentially affected by the defect. It also proposed to substitute "line" for "model" as one of the identifying classifications describing potentially affected vehicles.

The comments demonstrated that the vehicle identification number is a useful tool for locating second and later owners of vehicles. In a study conducted by the Ford Motor Company and the State Farm Insurance Company, a fairly significant percentage of owners who either had not received or responded to the initial notification mailed by the manufacturer did respond to subsequent letters sent on the basis of the VIN.

As a result of comments received, however, the NHTSA has decided that vehicle identification numbers should only be required to be supplied in the second "quarterly report", approximately six months after a campaign is initiated, rather than in the defect information report as proposed. Only the VIN's for vehicles not repaired by that date are required to be provided. The NHTSA believes this approach will provide the safety benefits to be derived from having publicly available lists of defective vehicle VIN's and will also reduce duplication and facilitate the agency's efforts to compile and report the information.

The NHTSA requests that vehicle identification numbers be submitted in a form suitable for automatic data processing (magnetic tape, discs, punched cards, etc.) when more than 500 numbers are reported for any single campaign. While not required by this notice, the use of automatic data processing for large campaigns will facilitate the dissemination of the information for the agency. The agency may include specific requirements in this regard at a later time.

The comments argued that the benefits of having VIN's available during the initial stages of a campaign are limited, and that the compilation of identification numbers for every vehicle in a campaign would create significant problems for manufacturers related to conducting campaigns. The NHTSA believes these comments to have merit. It is clear that the chief use of VIN's will be to notify other than first purchasers, *i.e.*, owners of older vehicles, as the names of these owners will not be available to manufacturers. By delaying the furnishing of VIN's until the filing of the second quarterly report, the VIN's reported will represent to a greater

degree the names and addresses of second and later owners. The later reporting will also reduce the possibility that first purchasers will receive duplicate notices.

Many comments challenged generally the utility of the VIN in notification campaigns. Other comments complained that insurance companies might abuse the information; for example, by cancelling policies on defective vehicles. Still others believed VIN's to be privileged proprietary information, both taken separately and when combined with other information submitted pursuant to Part 573.

While it is true that the effectiveness of the requirement will depend to an extent upon the voluntary activities of third parties, the NHTSA does not view this as a reason not to issue the requirement. The offers of insurance companies and other groups to participate in notification campaigns appear to be reasonable and properly motivated. There has been no evidence brought to the NHTSA's attention to support the allegations of possible misuse of the information by insurance companies.

The agency also cannot agree that information identifying defective vehicles is or relates to proprietary information. The comments on this point seem to equate what may be embarrassing information with notions of confidentiality. There is no basis under existing statutory definitions of confidentiality for including within them VIN's or other information identifying defective vehicles.

The proposed substitution of "line" for "model" in the descriptive information for vehicles was opposed in one comment because the term "line" is apparently more suited for passenger cars than other vehicle types. The comment indicated that "model" is a more appropriate term for trucks. In light of this comment, the terms are specified as alternatives in the regulation.

In light of the above, Part 573 of Title 49, Code of Federal Regulations, "Defect Reports," is amended. . . .

Effective date: May 6, 1974.

(Sections 103, 112, 113, and 119, Pub. L. 89–563, 80 Stat. 718; 15 U.S.C. 1392, 1401, 1402, 1407, and the delegation of authority at 49 CFR 1.51 Office of Management and Budget Approved 04–R5628.)

Issued on January 30, 1974.

James B. Gregory
Administrator

39 F.R. 4578
February 5, 1974

PREAMBLE TO AMENDMENT TO PART 573—DEFECT REPORTS

(Docket No. 69-31; Notice 6)

This notice responds to petitions for reconsideration of the amendment of 49 CFR Part 573, "Defect Reports," requiring the submission to NHTSA of the vehicle identification numbers (VIN) of motor vehicles found to contain safety related defects. The amendment was published February 5, 1974 (39 F.R. 4578). Except insofar as granted by this notice, the requests of the petitioners are denied.

Two petitions for reconsideration, one from General Motors Corporation and the other from Chrysler Corporation, were received. Both petitions objected to the requirement that VIN's be reported in the second quarterly report filed subsequent to the initiation of the defect notification campaign. Both pointed out that the NHTSA had stated in the amendment published February 5, 1974, that it was desirable to defer reporting VIN's until six months had passed from the time a notification campaign had begun. Both petitioners argued that the time for filing the second quarterly report is frequently less than six months, and suggested that the third quarterly report rather than the second was the more appropriate quarterly report to contain vehicle identification numbers. General Motors indicated that the average elapsed time from the initiation of a notification campaign to the filing of the second quarterly report is four and one-half months, while the elapsed time until the filing of the third quarterly report is, on the average, seven and one-half months. The NHTSA still believes it reasonable to allow a six-month period from the initiation of the campaign to elapse before VIN's are submitted. Accordingly, the NHTSA has granted the petitions insofar as they request that VIN's be reported in the third quarterly report submitted to NHTSA by the manufacturer.

Chrysler objected to the VIN reporting requirement generally, on the basis that it is unnecessary and will not produce the desired results. It is requested that an evaluation of the usefulness of the requirement be conducted after it is in effect, and that appropriate modifications be made if the requirement fails to achieve the desired results. General Motors requested that NHTSA maintain a public record of requests for VIN's so that future consideration can be given to the extent that the data is useful, and to whom it is useful. The NHTSA believes that public availability of VIN's will facilitate locating and repairing defective vehicles no longer in the hands of first purchasers. At the same time it agrees to conduct an evaluation of the efficacy of the requirement once it is in effect. The extent of usage is a relevant aspect of an evaluation of this type, and the NHTSA sees no prohibition against maintaining a public record of requests for the information.

The amended regulation will be effective August 6, 1974, and as such will require all third quarterly reports submitted to NHTSA on or after that date to contain appropriate vehicle identification numbers. The effective date has been changed from May 6, 1974, as a result of the change requiring the third rather than the second quarterly report to contain VIN's. As a practical matter, VIN's will be required to be reported in the third quarterly report for all defect notification campaigns initiated on or after January 1, 1974 (NHTSA campaign numbers 74-0001 and subsequent campaigns).

In light of the above, 49 CFR Part 573, Defect Reports, is amended by revising § 573.5(e) . . . .

Effective date: August 6, 1974.

(Secs. 103, 112, 113, and 119, Pub. L. 89-563, 80 Stat. 718; 15 U.S.C. 1392, 1401, 1402, 1407, and the delegation of authority at 49 CFR 1.51; Office of Management and Budget approved 04-R5628.)

Issued on May 6, 1974.

Gene G. Mannella
Acting Administrator

39 F.R. 16469
May 9, 1974

PREAMBLE TO AMENDMENT TO PART 573—DEFECT REPORTS

(Docket No. 74-7; Notice 2)

This notice amends Part 573—"Defect Reports" by revoking the requirement that manufacturers of motor vehicles report quarterly to the National Highway Traffic Safety Administration production figures for vehicles manufactured or imported during the calendar quarter. A notice of proposed rulemaking in which this amendment was proposed was published January 15, 1974 (39 FR 1863).

The NHTSA is revoking the requirement for the reporting of quarterly production figures because it has found that the value of the information has not justified the burden on manufacturers of providing it. This amendment will eliminate the need for manufacturers to file quarterly reports unless they are conducting notification campaigns during the calendar quarter.

The notice of proposed rulemaking of January 15, 1974, proposed to extend the applicability of the Defect Reports regulations to include manufacturers of motor vehicle equipment, and to modify the information required to be reported. Since the issuance of this proposal, Congress has amended sections of the National Traffic and Motor Vehicle Safety Act which deal with manufacturers' responsibilities for safety related defects in motor vehicles and motor vehicle equipment. (Pub. L. 93-492, Oct. 27, 1974) These amendments to the Safety Act in part enlarge the responsibilities of manufacturers of motor vehicle equipment for safety related defects. Ultimately the Defect Reports regulations will reflect completely the expanded scope of the statutory amendments. While the language of the proposed rule of January 15, 1974, is in most cases sufficiently broad to reflect these statutory changes, the scope of the proposal under the previous language of the Safety Act is materially different. Consequently, the NHTSA has decided to issue a further notice, with opportunity for public comment, that specifically reflects the expanded scope of the statutory amendments. This notice will be issued at some time following the effective date (December 26, 1974) of the statutory amendments.

The NHTSA has determined, however, that relief from the production-figures reporting requirements should not be further deferred, and by this notice deletes those requirements from the Defect Reports regulation.

In light of the above, 49 CFR Part 573, Defect Reports, is amended by revoking and reserving paragraph (b) of section 573.5 ("Quarterly reports").

Effective date: December 10, 1974. This amendment relieves a restriction and imposes no additional burden on any person. Consequently good cause exists and is hereby found for an effective date less than 30 days from publication.

(Secs. 108, 112, 113, 119, Pub. L. 89-563, 80 Stat. 718, 15 U.S.C. 1397, 1401, 1402, 1408; delegation of authority at 49 CFR 1.51)

Issued on December 4, 1974.

James B. Gregory
Administrator

39 F.R. 43075
December 10, 1974

PREAMBLE TO AMENDMENT TO PART 573—DEFECT AND NONCOMPLIANCE REPORTS

(Docket No. 74-7; Notice 4)

This notice amends Part 573, *Defect and Noncompliance Reports*, by adding reporting requirements for equipment manufacturers and altering somewhat the requirements for vehicle manufacturers as authorized by the 1974 Motor Vehicle and Schoolbus Safety Amendments. The amended regulation requires the submission of reports to the agency concerning defects and noncompliance with safety standards and specifies the information to be included in those reports.

Effective date: January 25, 1979.

Addresses: Petitions for reconsideration should refer to the docket number and be submitted to: Room 5108, Nassif Building, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

For further information contact:

Mr. James Murray, Office of Defects Investigation, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2840)

Supplementary information:

This notice amends Part 573, *Defect and Noncompliance Reports.* A notice of proposed rulemaking was published on September 19, 1975 (40 F.R. 43227), proposing new requirements for vehicle and equipment manufacturers regarding submittal to the NHTSA of defect and noncompliance reports as authorized by the Motor Vehicle and Schoolbus Safety Amendments of 1974 (the Amendments) (Pub. L. 93-492).

Sections 151 to 160, or Part B of the Amendments alter the defect notification requirements of the National Traffic and Motor Vehicle Safety Act of 1966 ("the Act") (15 U.S.C. 1381 *et seq.*). These Amendments require manufacturers of motor vehicle replacement equipment to notify purchasers and to remedy any defects or noncompliances following the manufacturer's or the Administrator's determination that the equipment contains either a defect which relates to motor vehicle safety or a noncompliance with an applicable Federal motor vehicle safety standard. Prior to the enactment of these provisions, manufacturers of motor vehicle equipment were responsible under the Act for notification of defects or noncompliances only following a determination by the National Highway Traffic Safety Administrator that the item of equipment contained a safety-related defect or failed to comply (Sec. 113(e), Pub. L. 89-563, 15 U.S.C. 1402).

Comments on the proposal were received from manufacturers, safety organizations, and manufacturer representatives. The Vehicle Equipment Safety Commission did not submit comments. All comments were considered and the most significant ones are discussed below.

I. Scope.

Several manufacturers objected to the scope of the regulation indicating that it exceeded the agency's authority to regulate vehicle and equipment manufacturers. For example, manufacturers alleged that the agency only has authority over safety-related defects and accordingly should restrict the defects mentioned in this section to safety-related defects. Further, many equipment manufacturers apparently thought that they would be required to retain purchaser and owner lists of all vehicles containing items of their equipment.

The intent of this regulation is not to impose upon equipment manufacturers recordkeeping requirements for all equipment that they manufacture. This regulation merely imposes limited recordkeeping requirements for that equipment which is determined to be defective or in noncompliance. In other words, an equipment manufacturer, after discovery of a defect or

noncompliance, would ascertain from a vehicle manufacturer the identity of the vehicles and vehicle owners possessing the affected equipment. Notification would then be sent to those owners. The NHTSA would require that the equipment manufacturer retain the records of those sent notice of the defect.

Several manufacturers requested that the agency limit the applicability of this regulation to safety-related defects. They argued that the NHTSA has no authority to require information pertaining to non-safety-related defects. Section 158 of the Act specifically authorizes the agency to require information on any defect, whether or not safety-related, in order to enable it to undertake defect investigations which permit a determination regarding the safety-related nature of the defect. Much of this regulation pertains only to safety-related defects and each section indicates whether it applies to all defects or only those that are safety related.

II. Application.

Many manufacturers complained about the use of the term "direct control" in Section 573.3(a). Some manufacturers contended that the use of the term was unnecessary. Importers contended that they should not be required to submit reports where a defect is identified before the vehicles leave their direct control since the Act considers them to be manufacturers and they would be in direct control of vehicles being imported. The Center for Auto Safety would have the agency drop the term and replace it with "beyond their place of final manufacture."

In the notice of proposed rulemaking, the NHTSA indicated the reasoning for excluding vehicles and equipment within the "direct control" of the manufacturer from the reporting requirements. Vehicles and equipment within the direct control of manufacturers are virtually assured of remedy of any defect or noncompliance, because they are still within the physical possession of the manufacturer. In the NPRM it was noted that direct control does not include in the possession of a dealer or distributor. For vehicles and equipment possessed by those entities, reports concerning defects or noncompliance would be required to be submitted to the agency. The agency declines to adopt the suggestion of the Center for Auto Safety for reasons explained in the NPRM. The phrase "beyond the place of final manufacture" is not broad enough to handle all instances where vehicles are still within the direct control of the manufacturer. For example, vehicles might be stored on a manufacturer's lot far removed from the place of manufacture. Nonetheless, these vehicles are still within the direct control of the manufacturer. Therefore, the agency concludes that the term "direct control" best accomplishes the objective of providing a limited exclusion from the reporting requirements. The agency agrees with importers that since they are considered manufacturers under the Act, vehicles that manifest defects while they are within their direct control are excluded from the reporting requirements.

Some manufacturers apparently misunderstood the requirements of Section 573.3(d). Manufacturers indicated that reports should be required to be filed either by the brand name owner or the manufacturer, not by both. The section as written permits this. Compliance with the reporting requirements by the brand name owner shall be considered compliance by the manufacturer. Either one is permitted to submit the required reports. The Act treats tire brand name owners as manufacturers. Therefore, the wording of this section has been changed to reflect the responsibility of tire brand name owners.

Several commenters requested that the name of fabricating manufacturers not be submitted since this might cause competitive disadvantage to the brand name or trademark owner. The NHTSA finds it a legitimate need to know the actual manufacturer of a product. That manufacturer could, for example, be manufacturing the same or similar components for other brand name or trademark owners. The agency would need this information to ensure that all potentially defective or noncomplying equipment is remedied.

Many manufacturers complained of the requirements in Section 573.3(f) that reports be filed both by the equipment manufacturer and the vehicle manufacturer where an equipment manufacturer's equipment has been used by more than one vehicle manufacturer. Manufacturers stated that this requirement is duplicative and costly, providing identical information from both

sources. The NHTSA stated in the NPRM that this issue had been thoroughly considered prior to the issuance of the NPRM. It has again been explored by the agency in response to these comments and the agency concludes that the dual reporting requirement for the 573.5 report is necessary. Reports submitted by equipment and vehicle manufacturers will have different information in them. In both cases, the information is of importance to the agency in pursuing its defects and noncompliance obligations. Therefore, this requirement has been retained. It should be reaffirmed for clarity that where an equipment manufacturer's equipment is used in vehicles of only one vehicle manufacturer, reports need only be submitted by that vehicle manufacturer.

On a related matter, the NHTSA agrees that reports required under Section 573.6 need not be filed by both vehicle and equipment manufacturers. These reports need only be filed by the manufacturer undertaking the recall. Section 573.3(f) has been amended to reflect this change.

Other commenters on this section indicated their disapproval of the shared responsibility for remedying defects and noncompliance between vehicle and equipment manufacturers. Section 573.3 places certain reporting responsibilities upon both equipment and vehicle manufacturers, depending upon the nature of the defect. For the most part, vehicle manufacturers are responsible for reports relating to defects or noncompliance in their vehicles while equipment manufacturers are responsible for reports on their defective or noncomplying equipment. In those instances where a defect or noncompliance is discovered in equipment installed in the vehicles of more than one vehicle manufacturer, both the equipment and vehicle manufacturers must report. Equipment manufacturers suggested that vehicle manufacturers should be responsible for defects and noncompliance reports while vehicle manufacturers want to place the burdens upon equipment manufacturers. The NHTSA adopted the present scheme of shared responsibility between vehicle and equipment manufacturers for compliance with agency regulations in response to the 1974 Amendments. Congress indicated in those amendments that equipment and vehicle manufacturers should share the burden of remedying defects in their equipment and vehicles. The NHTSA concludes that the reporting requirements outlined in this regulation implement the basic intent of those Amendments.

III. Definitions.

Many commenters objected to the definitions of original and replacement equipment. Further, some of these commenters indicated that the NHTSA had little, if any, authority to place responsibility on an original equipment manufacturer, since Section 159 of the Act makes the vehicle manufacturers responsible for original equipment. The NHTSA has deleted the definitions of original and replacement equipment from Part 573 since both terms are defined in Part 579. The NHTSA notes that with respect to the authority to place responsibility for defects or noncompliance upon original equipment manufacturers rather than the vehicle manufacturer, Section 159 states that the Act's defect and noncompliance scheme of responsibility shall be controlling unless otherwise provided by regulation. Therefore, the NHTSA does have the authority to shift the responsibility from the vehicle manufacturer to the equipment manufacturer if it determines that such alteration will advance the efficiency of enforcement actions. Part 579, *Defect and Noncompliance Responsibility*, outlines the responsibilities of the various manufacturers and defines "replacement" and "original" equipment.

Commenters also requested that the agency define the term "safety-related defect" so as to clarify the agency's intent in this area. The NHTSA has in the past rejected requests to establish a specific definition of safety-related defect. Whether or not a defect is safety-related depends upon a variety of factors and must be ascertained based upon the circumstances of each separate case. Thus, a specific definition cannot feasibly be created.

Ford Motor Company argued that the agency's preambular discussion tended to indicate that the definition of "first purchaser for purposes other than resale" would include the dealer or distributor. This was not the intent of the regulation. "First purchaser" is based on a similar statutory term and has been used by the agency for years with a specific meaning. The first purchase oc-

curs where the purchaser does not buy the vehicle with the purpose of reselling it. Obviously, sale of a vehicle to a dealer presupposes that the dealer intends to resell the vehicle to the ultimate consumer or purchaser. Therefore, sale to a dealer would not constitute the sale to the first purchaser for purposes other than resale. The use of the term first-purchaser list in the preamble of the proposal in reference to the lists required to be retained by equipment manufacturers was a colloquial use of the term rather than its more precise meaning under the Act.

IV. Defect and noncompliance information reports.

Prestolite Company interpreted the requirements of Section 573.5(a) to mean that they would be required to file a report with the NHTSA every time a defective piece of equipment was brought to their attention, since there is no specific definition of safety-related defect. This they suggested would be a burdensome requirement. Such a requirement is not the intent of this regulation. A manufacturer submits a report to the NHTSA when either it or the agency makes a determination under Section 151 or 152 of the Act that a defect related to motor vehicle safety in fact exists. A failure of a single piece of equipment may not occasion the finding of a safety-related defect. Further, some equipment failures might have no adverse safety effects. Therefore, every failure of equipment will not necessarily require a report to the NHTSA. It is incumbent upon the agency and each manufacturer to make a good faith determination concerning the safety relatedness of any defect before a report under this paragraph is filed.

International Harvester (IH) suggested that a manufacturer should not have to file a report if it intends to file a petition for inconsequentiality. The NHTSA does not agree with this position. The agency needs to know of potential safety-related defects or noncompliances at the earliest possible time. If a manufacturer intends to file a petition for inconsequentiality, it should indicate such in the report as part of the information supplied in accordance with subparagraph (c)(8).

Many manufacturers objected to the 5-day requirement in Section 573.5(b) under which information must be submitted within 5 working days after a safety-related defect or noncompliance has been discovered. Manufacturers suggested increasing the number of working days and changing the word "submitted" to "mailed." Ford requested that the 5-day period not begin until written notification is received from the NHTSA for agency-initiated determinations.

The agency does not find persuasive arguments for altering the existing 5-working day requirement. The NHTSA needs this information as rapidly as possible to aid expeditious notification and recall. Not all information need be supplied within the 5 working days if some of it is unavailable. The regulation clearly states that any unavailable information would be submitted later as it becomes available. The NHTSA also considers it unnecessary to change the word "submitted" to "mailed." The term "submitted" is broader than "mailed." Information may be submitted by mailing it or delivering it to the agency in person. If mailed, it must be mailed within 5 working days.

With respect to the alleged insufficient time to prepare information in 5 working days, the NHTSA notes that this requirement has existed in Part 573 for several years. Since the requirement has operated smoothly for that period of time, the agency declines to adopt recommendations that would change it.

The NHTSA declines to adopt Ford's recommendation concerning agency-initiated determinations. Agency initiated defect or noncompliance determinations are made after thorough investigations conducted by the NHTSA. A manufacturer is aware of these ongoing investigations, and therefore, it should not be unnecessarily burdened or surprised when the NHTSA makes a determination. Since the need for expeditious action exists after an agency determination and the manufacturer is aware of a pending agency decision, the NHTSA considers it adequate that a manufacturer submit the report in 5 working days after receipt of either written or oral agency notification.

Several equipment manufacturers contended that the requirements of paragraph (c)(2) would impose additional burdens upon them to mark the equipment that they manufacture. Paragraph (c)(2) requires defect and noncompliance reports

to contain certain information that identifies the defective or noncomplying equipment. For example, they argued that the requirements for the date of manufacture of the affected equipment would be burdensome since much of their equipment is not dated according to time of manufacture. Therefore, they suggested that the NHTSA only require date of manufacture information when it is known.

It is important to remember that Part 573 is for the most part a reporting regulation. It is not a recordkeeping or labeling regulation. A manufacturer, under the regulation, only supplies to the NHTSA that information which is available to it. In the case of date of manufacture of equipment, the equipment manufacturer in most instances need not label its equipment in such a manner as to identify its date of manufacture. The regulation merely directs a manufacturer to supply such information to the NHTSA in its reports. Obviously, if a manufacturer does not know the dates of manufacture, it would be unable to supply them to the agency. However, a manufacturer must supply the approximate dates of manufacture if that information is available.

Manufacturers should note that the manufacturing date requirement is included in the regulation for the benefit of the equipment manufacturer. If that manufacturer knows the approximate dates when a defective piece of equipment was produced, then its recall can be limited to equipment manufactured during those dates. On the other hand, a manufacturer without such information might be required to undertake a more extensive recall of its equipment to ensure that all defective products are recalled.

The Center for Auto Safety requested that the NHTSA require motor vehicle manufacturers to submit the vehicle identification numbers (VIN) of vehicles involved in any recall activity. The NHTSA does not require this information in the Part 573.5 reports because the agency normally has no need at the time of the reports issuance for such information. The agency does require the VIN's to be submitted in the Part 573.6 reports for those vehicles that are uncorrected in a manufacturer's recall. In these instances, the agency uses the information to supplement a manufacturer's recall efforts. Until such time as a manufacturer determines that some vehicles are uncorrected however, the agency usually has little use for VIN information on all recalled vehicles. In those limited instances when VIN information is necessary at the time of submission of the Part 573.5 report, the agency has the ability to request it from a manufacturer.

In regard to paragraph (c)(3), several manufacturers objected to the requirement that the precise number of vehicles or equipment in each category be reported. These manufacturers stated that often this information is not known. The NHTSA agrees and therefore modifies the section to require the submittal of this information when it is known. Chrysler suggested that the agency require the numbers of affected vehicles to be submitted by GVWR breakdown rather than by model. The agency disagrees with this recommendation since it usually undertakes recalls based upon model classification, not upon GVWR categories. Therefore, the submission of information based upon a GVWR classification would not be as useful as a classification based upon vehicle model.

Atlas Supply Company suggested that the agency not require the information specified in paragraph (c)(4) since, for tire manufacturers, tires are destroyed, making the required calculations difficult. Paragraph (c)(4) requires the provision of information that estimates the percentage of defective or noncomplying equipment on vehicles. The NHTSA considers estimates of the amount of affected vehicles or equipment to be necessary to obtain an idea of the scope of the defect or noncompliance problem. Since the section merely requires an estimate, the agency does not consider this to place a difficult burden upon manufacturers.

Many manufacturers complained about the requirements of paragraph (c)(6) which requires the submission of information upon which the determination was made that a safety-related defect exists. These manufacturers indicated that it would impose unreasonable burdens upon manufacturers by requiring them to retrieve a large amount of information in a short period of time and to retain vast amounts of data. The intent of this section is to provide a summary to the NHTSA of the information upon which a

manufacturer based his defect determination. This information, since it has been used by a manufacturer for its determination of a defect, should be readily available to it. The NHTSA notes that the submission of summary information is intended to reduce a manufacturer's burdens. However, the specificity and clarity of information must be maintained, and the agency might require further information if the summary information is inadequate. The NHTSA has reworded the paragraph somewhat to indicate that it is only necessary to submit a summary of the information upon which the determination was based.

Several manufacturers suggested that the requirement for submission of noncompliance test data in paragraph (c)(7) would require them to conduct tests and submit details of test procedures to the agency. This paragraph requires only that manufacturers supply the results and data of tests, if any are conducted, upon which a noncompliance determination was based. Test procedures need not be submitted. If a noncompliance determination is made on information other than tests, then that information would be submitted.

Manufacturers claimed that they would be unable to submit a plan for remedy as required by paragraph (c)(8) in the required 5 working days. The NHTSA needs to have an indication of a manufacturer's plan for remedy as soon as possible. Like all of the information required by this section, the plan need not be extensively detailed in the initial 5-working day period and is subject to modification if subsequent circumstances warrant a change. In other words, a manufacturer is not binding itself to only those items established in the plan submitted during the first 5 days after a defect or noncompliance has been determined to exist. The NHTSA has amended the wording of this paragraph somewhat to indicate that a copy of a manufacturer's plan for remedying a defect or noncompliance will be made public in the NHTSA docket.

The Center for Auto Safety argued that paragraph (c)(9) should require actual copies of the defect or noncompliance notice bulletins or communications, not representative copies. The reason the NHTSA used the terminology contained in the notice is that in some instances a manufacturer has a multiple mailing of one communication. To require actual copies of multiple mailings would require copies of each of these identical communications. Therefore, the agency allows a representative copy (e.g., one actual copy) of such information. The NHTSA concludes that this requirement fulfills the agency's need for accurate copies.

V. Quarterly defect reports.

Many manufacturers disagreed with the agency's scheme for quarterly defect reports outlined in Section 576.6. Equipment manufacturers suggested that vehicle manufacturers should be responsible for these reports, while vehicle manufacturers asserted that the equipment manufacturers are better able to accomplish the reporting requirements. The NHTSA requires any manufacturer, either vehicle or equipment, undertaking a recall to comply with the quarterly reporting requirement. This report tells the agency the status of recalls, and therefore, is best accomplished by the party conducting the recall. The NHTSA declines to adopt suggestions that would change this scheme.

Subparagraph (b)(6) requires the submission of information on the number of vehicles or equipment that is determined to be unreachable. Several manufacturers argued for deletion of this information suggesting that it was impossible to ascertain why certain vehicles or equipment are unreachable. The manufacturer need only give the reasons why vehicles are unreachable when such information is available to him. This information aids the agency in understanding the effectiveness of a recall. The agency can determine from this data the number of vehicles still in use that were not corrected by a manufacturer and why.

VI. Purchaser and owner lists.

The intent of this section was misunderstood by a number of commenters. Many manufacturers, both equipment and vehicle, indicated that this requirement burdened them with new recordkeeping requirements far beyond those currently in existence. This is not the case. For example, Part 573.7(a) requires vehicle manufacturers to maintain lists of owners of vehicles involved in a

notification campaign, not all vehicles produced. General recordkeeping requirements for vehicle and equipment manufacturers are found in the Act and in the agency's regulations in Part 576. These general recordkeeping requirements are not affected by this regulation.

Equipment manufacturers strenuously objected to paragraph (c) as placing huge recordkeeping burdens upon them while achieving little in the way of benefits. The agency does not find these arguments persuasive. The recordkeeping requirement in this paragraph is limited. The agency has reworded this section to clarify an equipment manufacturer's recordkeeping requirements. This requirement does not mandate an equipment manufacturer to make and retain a list of all purchasers of its equipment as the equipment is sold. Equipment manufacturers will be required to retain a list of individuals, dealers, distributors and manufacturers determined by the manufacturer or the agency to be in possession of potentially defective or noncomplying equipment. This limited requirement is within the authority granted by Section 112(b) of the Act. The list would be compiled during the course of a defect or noncompliance campaign. If an equipment manufacturer is unable to find those in possession of its equipment, no list is required to be retained. The burden imposed by this requirement is minimal since it merely requires that manufacturers retain some information that will, by necessity, be generated should they be required to conduct either a defect or noncompliance campaign.

With respect to paragraph (b), tire manufacturers indicated that each tire does not have a different identification number and therefore the paragraph should be amended somewhat to reflect this. The agency agrees and has modified the language accordingly.

VII. Notices, bulletins, and other communications.

Many manufacturers objected to the requirements in Section 573.8 as being too broad and beyond the scope of the NHTSA's authority. This section requires the submission of information concerning defects in equipment and vehicles. Further, the manufacturers recommended that the parentheticals be deleted from the section and that the term "defect" be changed to "safety-related defect." The agency does not agree with these comments.

First, the agency needs information concerning any defect in a manufacturer's product, not just those defects that a manufacturer deems to be safety-related. The Act contemplates a two-pronged approach to defects determinations. Either a manufacturer or the agency can make such a determination. For the agency to carry out its half of that responsibility, it needs information pertaining to all defects so that it can then judge for itself whether a defect is in fact safety related. To require only information pertaining to manufacturer-determined safety-related defects, would in effect mean that manufacturers would not be required to submit defect information to the agency until such time as that manufacturer had made a safety-related defect determination. This would stymie the agency's ability to make independent judgments concerning defects that is necessary for proper enforcement of the Act. In the past year, the NHTSA has made several safety-related defect determinations on the basis of information routinely submitted by manufacturers concerning defects that they had not considered safety-related. For example, some Airstream Trailers and White Trucks were recalled when the agency discovered safety-related problems that were mentioned in those companies' technical bulletins. Therefore, the agency needs all types of defect information, not just information that manufacturers determine to be safety-related.

Second, the parentheticals were added to this section to help clarify the type of information intended to be covered by its requirements. These lists are not all-inclusive. The NHTSA concludes, however, that they do clarify the type of information the agency seeks to obtain from a manufacturer, and therefore, they will be retained in the regulation.

The agency has deleted from Section 573.8 all references to noncompliances. All noncompliances must be reported to the agency under Part 573.5 (c)(9). Therefore, it is unnecessary to include references to noncompliances in this paragraph.

In response to the allegations that the agency has no authority to require submittal of defect

information, whether or not safety related, Section 158 of the Act specifically grants the agency that authority.

VIII. Address for submitting required reports and other information.

The address listed in Part 573.9 has been altered to reflect the new agency organization and authority for enforcement actions.

In accordance with agency policy, the NHTSA has considered the costs and benefits of this requirement. The agency concludes that the regulation will help enforcement of defect and noncompliance cases by ensuring that adequate information is submitted to the NHTSA. The costs to both industry and government of the regulation will be less than $5 million annually.

The principal authors of this notice are James Murray of the Office of Defects Investigation and Roger Tilton of the Office of Chief Counsel.

In consideration of the foregoing, Part 573, *Defect and Noncompliance Reports*, of Volume 49 of the Code of Federal Regulations is amended. . . .

(Secs. 108, 112, 119, Pub. L. 89–563, 80 Stat. 718; Secs. 102, 103, 104, Pub. L. 93–492; 88 Stat. 1470; 15 U.S.C. 1397, 1401, 1408, 1411–1420; delegation of authority at 49 CFR 1.50.)

Issued on December 18, 1978.

Joan Claybrook
Administrator

43 F.R. 60165–60169
December 26, 1978

PREAMBLE TO AN AMENDMENT TO PART 573

Defect and Noncompliance Reports (Docket No. 74-7; Notice 7)

ACTION: Final Rule.

SUMMARY: The purpose of this final rule is to amend 49 CFR Part 573—*Defect and Noncompliance Reports,* to delete certain reporting requirements for motor vehicle or motor vehicle equipment manufacturers conducting a defect or noncompliance notification campaign. Under this rule, motor vehicle manufacturers no longer have to submit, in the third quarterly report to the agency, the vehicle identification number (VIN) for each vehicle for which corrective measures have not been completed. Other quarterly report information requirements are also deleted or clarified, based on the agency's experience since 1974 with this portion of the defect and noncompliance reports.

EFFECTIVE DATE: January 6, 1986

SUPPLEMENTARY INFORMATION: Part 573—*Defect and Noncompliance Reports,* includes requirements for manufacturers to report to NHTSA safety-related defects and nonconformities with Federal motor vehicle safety standards, to maintain lists of purchasers and owners notified of defective and noncomplying motor vehicles and items of equipment, and to provide the agency with quarterly reports on the progress of defect and noncompliance notification campaigns. The quarterly reports must contain specified information and be submitted for six consecutive quarters after initiation of a campaign, unless corrective action is completed earlier.

This rule amends only section 573.6 of Part 573 which sets forth the information required to be submitted to the agency in these quarterly reports. The notice of proposed rulemaking, which was issued on March 27, 1985 (50 FR 12056), proposed to delete or clarify certain information requirements in the third quarterly report. This amendment was proposed in response to a petition by the Motor Vehicle Manufacturers Association (MVMA). The agency received comments on the proposal from nine motor vehicle manufacturers and the MVMA. All comments supported the proposal as lessening an administrative and cost burden. The agency is adopting the changes as proposed.

First, the rule deletes the requirement in section 573.6(b)(7) that manufacturers submit, in the third quarterly report to the agency, the VIN for each vehicle for which corrective measures have not been completed. All commenters supported this change, stating that the deletion of these VIN's from the third quarterly report would lessen the administrative and cost burdens of producing the information and would not adversely affect the progress of safety campaigns. In addition, all commenters agreed that these VIN's would be supplied to the agency, if requested, within a reasonable time.

As stated in the proposal, this rule will not change the agency's practice of assisting any individual vehicle owner who requests recall information about a particular vehicle or item of equipment. The agency will continue to provide information to enable the owner to contact the appropriate office of the manufacturer.

Second, this rule also deletes the requirement in section 573.6(b)(4) that each quarterly report include the number of vehicles or items of equipment estimated to contain the defect. This total number is initially supplied to NHTSA under the requirements of section 573.5 which states that the manufacturer's first report must include information specifically identifying the vehicles or items of equipment potentially containing the defect or noncompliance, and the percentage of those vehicles or equipment items estimated to actually contain the defect or noncompliance.

The agency's purpose in having this number updated in the quarterly reports has been to determine the potential size of notification campaigns. Ford Motor Company stated that updated information could be sent, if needed, within 10 working days. Ford added that information requiring supplier analysis on returned components would take longer. The agency concludes that updated estimates in the quarterly reports are no longer necessary. NHTSA will continue to receive quarterly report information on the number of vehicles or items of equipment involved in the notification campaign under section 573.6(b)(3). The requirement in section 573.6(b)(4) is therefore deleted in the rule.

Third, commenters also agreed with the proposed amendment to the language in section 573.6(b)(5) which clarifies the agency's intent that the number of vehicles and equipment items inspected and repaired and the number inspected and determined not to need repair should be separately reported. The rule adopts this clarification.

Fourth, the rule deletes the requirement in section 573.6(c) concerning the correction of errors in quarterly reports. Under this section, manufacturers must submit revised information in quarterly reports when they determine that an original report contained incorrect data concerning the number of vehicles or items of equipment (1) involved in a notification campaign, (2) estimated to contain the defect, or (3) determined to be unreachable for inspection for any reason. The agency does not believe submittal of this information on a regular basis is necessary and commenters agreed, adding the data could be supplied if necessary, upon request from NHTSA.

In their comments, Ford requested that the final sentence of section 573.6(b)(6) be deleted. This section requires that the number of vehicles or items of equipment, which are determined to be unreachable for inspection due to export, theft, scrapping, failure to receive notification, or other reasons, be reported to NHTSA. The last sentence of the section requires that the number of vehicles or items of equipment in each of these categories be specified. The agency did not propose in the March notice that this sentence be deleted, because this information is utilized by the agency. For example, NHTSA keeps track of the number of owners who were unreachable to assist the agency in determining whether renotification to new owners is necessary or whether additional types of notification should be adopted. Moreover, the manufacturers currently receive notice of whether a vehicle or equipment item has been exported, stolen, or scrapped by return postcard, from the person notified of the campaign. Therefore, this requirement is not changed.

In consideration of the foregoing, 49 CFR Part 573 is amended as follows:

1. The authority citation for Part 573 is revised to read as follows:

AUTHORITY: 15 U.S.C. 1397, 1401, 1408, 1411-20; delegation of authority at 49 CFR 1.50.

2. Section 573.6 is revised to read as follows:

Section 573.6 *Quarterly Reports*

(a) Each manufacturer who is conducting a defect or noncompliance notification campaign to manufacturers, distributors, dealers, or purchasers, shall submit to NHTSA a report in accordance with paragraphs (b) and (c) of this section, not more than 25 working days after the close of each calendar quarter. Unless otherwise directed by the NHTSA, the information specified in paragraphs (b)(1) through (5) of this section shall be included in the quarterly report, with respect to each notification campaign, for each of six consecutive quarters beginning with the quarter in which the campaign was initiated (i.e., the date of initial mailing of the defect or noncompliance notification to owners) or corrective action has been completed on all defective or noncomplying vehicles or items of replacement equipment involved in the campaign, whichever occurs first.

(b) Each report shall include the following information identified by and in the order of the subparagraph headings of this paragraph.

(1) The notification campaign number assigned by NHTSA.

(2) The date notification began and the date completed.

(3) The number of vehicles or items of equipment involved in the notification campaign.

(4) The number of vehicles and equipment items which have been inspected and repaired and the number of vehicles and equipment items inspected and determined not to need repair.

(5) The number of vehicles or items of equipment determined to be unreachable for inspection due to export, theft, scrapping, failure to receive notification, or other reasons (specify). The number of vehicles or items of equipment in each category shall be specified.

(c) Information supplied in response to the paragraphs (b)(4) and (5) of this section shall be cumulative totals.

Issued on: December 31, 1985.

Diane K. Steed
Administrator
51 F.R. 397
January 6, 1986

PART 573—DEFECT AND NONCOMPLIANCE REPORTS

(Docket No. 74-7; Notice 4)

[AUTHORITY: 15 U.S.C. 1397, 1401, 1408, 1411–20; delegation of authority at 49 CFR 1.50. **(51 F.R. 397—January 6, 1986. Effective: January 6, 1986)]**

§ 573.1 Scope.

This part specifies requirements for manufacturers to maintain lists of purchasers and owners of defective and noncomplying motor vehicles and motor vehicle original and replacement equipment, and for reporting to the National Highway Traffic Safety Administration defects in motor vehicles and motor vehicle equipment, for reporting noncomformities to motor vehicle safety standards, for providing quarterly reports on defect and noncompliance notification campaigns, and for providing copies to NHTSA of communications with distributors, dealers, and purchasers regarding defects and noncompliances.

§ 573.2 Purpose.

The purpose of this part is to inform NHTSA of defective and noncomplying motor vehicles and items of motor vehicle equipment, and to obtain information for NHTSA on the adequacy of manufacturers' defect and noncompliance notification campaigns, on corrective action, on owner response, and to compare the defect incidence rate among different groups of vehicles.

§ 573.3 Application.

(a) This part applies to manufacturers of complete motor vehicles, incomplete motor vehicles, and motor vehicle original and replacement equipment, with respect to all vehicles and equipment that have been transported beyond the direct control of the manufacturer.

(b) In the case of a defect or noncompliance determined to exist in a motor vehicle or equipment item imported into the United States, compliance with §§ 573.5 and 573.6 by either the fabricating manufacturer or the importer of the vehicle or equipment item shall be considered compliance by both.

(c) In the case of a defect or noncompliance determined to exist in a vehicle manufactured in two or more stages, compliance with §§ 573.5 and 573.6 by either the manufacturer of the incomplete vehicle or any subsequent manufacturer of the vehicle shall be considered compliance by all manufacturers.

(d) In the case of a defect or noncompliance determined to exist in an item of replacement equipment (except tires) compliance with §§ 573.5 and 573.6 by the brand name or trademark owner shall be considered compliance by the manufacturer. Tire brand name owners are considered manufacturers (15 U.S.C. 1419(1)) and have the same reporting requirements as manufacturers.

(e) In the case of a defect or noncompliance determined to exist in an item of original equipment used in the vehicles of only one vehicle

manufacturer, compliance with §§ 573.5 and 573.6 by either the vehicle or equipment manufacturer shall be considered compliance by both.

(f) In the case of a defect or noncompliance determined to exist in original equipment installed in the vehicles of more than one vehicle manufacturer, compliance with § 573.5 is required of the equipment manufacturer as to the equipment item, and of each vehicle manufacturer as to the vehicles in which the equipment has been installed. Compliance with § 573.6 is required of the manufacturer who is conducting a recall campaign.

§ 573.4 Definitions.

For purposes of this part:

"Act" means the National Traffic and Motor Vehicle Safety Act of 1966, as amended (15 U.S.C. 1391 *et seq.*).

"Administrator" means the Administrator of the National Highway Traffic Safety Administration or his delegate.

"First purchaser" means first purchaser for purposes other than resale.

§ 573.5 Defect and noncompliance information report.

(a) Each manufacturer shall furnish a report to the NHTSA for each defect in his vehicles or in his items of original or replacement equipment that he or the Administrator determines to be related to motor vehicle safety, and for each noncompliance with a motor vehicle safety standard in such vehicles or items of equipment which either he or the Administrator determines to exist.

(b) Each report shall be submitted not more than 5 working days after a defect in a vehicle or item of equipment has been determined to be safety-related, or a noncompliance with a motor vehicle safety standard has been determined to exist. Information required by paragraph (c) of this section that is not available within that period shall be submitted as it becomes available. Each manufacturer submitting new information relative to a previously submitted report shall refer to the notification campaign number when a number has been assigned by the NHTSA.

(c) Each manufacturer shall include in each report the information specified below.

(1) The manufacturer's name: The full corporate or individual name of the fabricating manufacturer and any brand name or trademark owner of the vehicle or item of equipment shall be spelled out, except that such abbreviations as "Co." or "Inc.," and their foreign equivalents, and the first and middle initials of individuals may be used. In the case of a defect or noncompliance determined to exist in an imported vehicle or item of equipment, the agent designated by the fabricating manufacturer pursuant to section 110(e) of the National Traffic and Motor Vehicle Safety Act (15 U.S.C. 1399(e)) shall be also stated. If the fabricating manufacturer is a corporation that is controlled by another corporation that assumes responsibility for compliance with all requirements of this part the name of the controlling corporation may be used.

(2) Identification of the vehicles or items of motor vehicle equipment potentially containing the defect or noncompliance.

(i) In the case of passenger cars, the identification shall be by the make, line, model year, the inclusive dates (month and year) of manufacture, and any other information necessary to describe the vehicles.

(ii) In the case of vehicles other than passenger cars, the identification shall be by body style or type, inclusive dates (month and year) of manufacture, and any other information necessary to describe the vehicles, such as GVWR or class for trucks displacement (cc) for motorcycles, and number of passengers for buses.

(iii) In the case of items of motor vehicle equipment, the identification shall be by generic name of the component (tires, child seating systems, axles, etc.), part number, size and function if applicable, the inclusive dates (month and year) of manufacture, and any other information necessary to describe the items.

(3) The total number of vehicles or items of equipment potentially containing the defect or noncompliance, and where available the number of vehicles or items of equipment in each group identified pursuant to paragraph (c) (2) of this section.

(4) The percentage of vehicles or items of equipment specified pursuant to paragraph (c) (2) of this section estimated to actually contain the defect or noncompliance.

(5) A description of the defect or noncompliance, including both a brief summary and a detailed description with graphic aids as necessary, of the nature and physical location (if applicable) of the defect or noncompliance.

(6) In the case of a defect, a chronology of all prinicipal events that were the basis for the determination that the defect related to motor vehicle safety, including a summary of all warranty claims, field or service reports, and other information, with their dates of receipt.

(7) In the case of a noncompliance, the test results or other data on the basis of which the manufacturer determined the existence of the noncompliance.

(8) A description of the manufacturer's program for remedying the defect or noncompliance. The manufacturer's program will be available for inspection in the public docket, Room 5109, Nassif Building, 400 Seventh St., SW., Washington, D.C. 20950.

(9) A representative copy of all notices, bulletins, and other communications that relate directly to the defect or noncompliance and are sent to more than one manufacturer, distributor, dealer, or purchaser. These copies shall be submitted to the NHTSA not later than 5 days after they are initially sent to manufacturers, distributors, dealers, or purchasers. In the case of any notification sent by the manufacturer pursuant to Part 577 of this chapter, the copy of the notification shall be submitted by certified mail.

§ 573.6 Quarterly reports.

[(a) Each manufacturer who is conducting a defect or noncompliance notification campaign to manufacturers, distributors, dealers, or purchasers, shall submit to NHTSA a report in accordance with paragraphs (b) and (c) of this section, not more than 25 working days after the close of each calendar quarter. Unless otherwise directed by the NHTSA, the information specified in paragraphs (b) (1) through (b) (5) of this section shall be included in the quarterly report, with respect to each notification campaign, for each of six consecutive quarters beginning with the quarter in which the campaign was initiated (i.e., the date of initial mailing of the defect or noncompliance notification to owners) or corrective action has been completed on all defective or noncomplying vehicles or items of replacement equipment involved in the campaign, whichever occurs first.

(b) Each report shall include the following information identified by and in the order of the subparagraph headings of this paragraph.

(1) The notification campaign number assigned by NHTSA.

(2) The date notification began and the date completed.

(3) The number of vehicles or items of equipment involved in the notification campaign.

(4) The number of vehicles and equipment items which have been inspected and repaired and the numbe of vehicles and equipment items inspected and determined not to need repair.

(5) The number of vehicles or items of equipment determined to be unreachable for inspection due to export, theft, scrapping, failure to receive notification, or other reasons (specify). The number of vehicles or items of equipment in each category shall be specified.

(c) Information suppied in response to the paragraphs (b) (4) and (b) (5) of this section shall be cumulative totals. **(51 F.R. 397—January 6, 1986. Effective: January 6, 1986)]**

§ 573.7 Purchaser and owner lists.

(a) Each manufacturer of motor vehicles shall maintain, in a form suitable for inspection such as computer information storage devices or card files, a list of the names and addresses of the registered owners, as determined through State motor vehicle registration records or other sources, or the most recent purchasers where the registered owners are unknown, for all vehicles involved in a defect or noncompliance notification campaign initiated after the effective date of this part. The list shall include the vehicle identification number for each vehicle and the status of remedy with respect to each vehicle, updated as of the end of each quarterly reporting period specified in § 573.6. Each list shall be retained, beginning with the date on which the defect or noncompliance information report required by § 573.5 is initially submitted to the NHTSA, for 5 years.

(b) Each manufacturer (including brand name owners) of tires shall maintain, in a form suitable for inspection such as computer information storage devices or card files, a list of the names and addresses of the first purchasers of his tires for all tires involved in a defect or noncompliance notification campaign initiated after the effective date of this part. The list shall include the tire identification number of all tires and shall show the status of remedy with respect to each owner involved in each notification campaign, updated as of the end of each quarterly reporting period specified in § 573.6. Each list shall be retained, beginning with the date on which the defect information report is initially submitted to the NHTSA, for 3 years.

(c) For each item of equipment involved in a defect or noncompliance notification campaign initiated after the effective date of this part, each manufacturer of motor vehicle equipment other than tires shall maintain, in a form suitable for inspection, such as computer information storage devices or card files, a list of the names and addresses of each distributor and dealer of such manufacturer, each motor vehicle or motor vehicle equipment manufacturer and most recent purchaser known to the manufacturer to whom a potentially defective or noncomplying item of equipment has been sold, the number of such items sold to each, and the date of shipment. The list shall show as far as is practicable the number of items remedied or returned to the manufacturer and the dates of such remedy or return. Each list shall be retained, beginning with the date on which the defect report required by § 573.5 is initially submitted to the NHTSA for 5 years.

§ 573.8 Notices, bulletins, and other communications.

Each manufacturer shall furnish to the NHTSA a copy of all notices, bulletins, and other communications (including warranty and policy extension communiques and product improvement bulletins), other than those required to be submitted pursuant to § 573.5(c) (9), sent to more than one manufacturer, distributor, dealer, or purchaser, regarding any defect in his vehicles or items of equipment (including any failure or malfunction beyond normal deterioration in use, or any failure of performance, or any flaw or unintended deviation from design specifications), whether or not such defect is safety-related. Copies shall be submitted monthly, not more than 5 working days after the end of each month.

§ 573.9 Address for submitting required reports and other information.

All required reports and other information, except as otherwise required by this part, shall be submitted to the Associate Administrator for Enforcement, National Highway Traffic Safety Administration, Washington, D.C. 20590.

43 F.R. 60169
December 26, 1978

PREAMBLE TO PART 572—ANTHROPOMORPHIC TEST DUMMY

(Docket No. 73-8; Notice 2)

The purposes of this notice are (1) to adopt a regulation that specifies a test dummy to measure the performance of vehicles in crashes, and (2) to incorporate the dummy into Motor Vehicle Safety Standard No. 208 (49 CFR § 571.208), for the limited purpose of evaluating vehicles with passive restraint systems manufactured under the first and second restraint options between August 15, 1973, and August 15, 1975. The question of the restraint system requirements to be in effect after August 15, 1975, is not addressed by this notice and will be the subject of future rulemaking action.

The test dummy regulation (49 CFR Part 572) and the accompanying amendment to Standard No. 208 were proposed in a notice published April 2, 1973 (38 F.R. 8455). The dummy described in the regulation is to be used to evaluate vehicles manufactured under sections S4.1.2.1 and S4.1.2.2, (the first and second options in the period from August 15, 1973, to August 15, 1975), and the section incorporating the dummy is accordingly limited to those sections. The dummy has not been specified for use with any protection systems after August 15, 1975, nor with active belt systems under the third restraint option (S4.1.2.3). The recent decision in *Ford* v. *NHTSA*, 473 F. 2d 1241 (6th Cir. 1973), removed the injury criteria from such systems. To make the dummy applicable to belts under the third option, the agency would have to provide additional notice and opportunity for comment.

By invalidating the former test dummy specification, the decision in *Chrysler* v. *DOT*, 472 F. 2d 659 (6th Cir. 1972), affected the restraint options in effect before August 15, 1975, as well as the mandatory passive restraint requirements that were to be effective after that date. A manufacturer who built cars with passive restraints under one of the options would therefore be unable to certify the cars as complying with the standard, as illustrated by the necessity for General Motors to obtain a limited exemption from the standard in order to complete the remainder of a run of 1,000 air-bag equipped cars.

The immediate purpose of this rulemaking is to reconstitute those portions of the standard that will enable manufacturers to build passive restraint vehicles during the period when they are optional. The test dummy selected by the agency is the "GM Hybrid II", a composite developed by General Motors largely from commercially available components. GM had requested NHTSA to adopt the Hybrid II on the grounds that it had been successfully used in vehicle tests with passive restraint systems, and was as good as, or better than, any other immediately available dummy system. On consideration of all available evidence, the NHTSA concurs in this judgment. One fact weighing in favor of the decision is that General Motors has used this dummy to measure the conformity of its vehicles to the passive protection requirements of Standard 208, in preparation for the announced introduction of up to 100,000 air-bag-equipped vehicles during the 1974 model year.

No other vehicle manufacturer has announced plans for the production of passive restraint systems during the optional phase, nor has any other vehicle manufacturer come forward with suggestions for alternatives to Hybrid II. The NHTSA would have considered other dummies had some other manufacturer indicated that it was planning to produce passive restraint vehicles during the option period and that some other dummy had to be selected in order to allow them to proceed with their plans. If there had

been any such plans, NHTSA would have made every effort to insure that a test device satisfactory to said manufacturer would have been selected.

This agency recognizes that since various types of dummy systems have been in use under the previous specification, any selection of one dummy, as is required by the *Chrysler* decision, will necessitate readjustments by some manufacturers. However, considering the quantity of GM's production, the scope and advanced state of its passive restraint development program, and the fact that the Hybrid II does not differ radically from other dummies currently in use, in the NHTSA's judgment that dummy represents the best and least costly choice. That conclusion has not been contradicted by the comments to the docket.

The agency will not make any final decision regarding reinstatement of mandatory passive restraint requirements without further notice and opportunity for comment. Should the agency propose mandatory passive restraint requirements, the question of the conformity of the dummy that is chosen with the instructions of the court in *Chrysler* will again be open for comment. The NHTSA strongly encourages the continuance of the dummy test programs mentioned in the comments, in the hope that any problems that may arise can be identified and resolved before the dummy specifications for later periods are issued.

The Hybrid II dummy has been found by NHTSA to be a satisfactory and objective test instrument. In sled and barrier tests conducted by GM with the GM restraint systems and in sled tests conducted by Calspan Corp. on behalf of NHTSA, the Hybrid II has produced results that are consistent and repeatable. This is not to say that each test at the same nominal speed and deceleration has produced identical values.

In testing with impact sleds, and to an even greater extent with crash-tested vehicles, the test environment itself is complex and necessarily subject to variations that affect the results. The test data show, however, that the variance from dummy to dummy in these tests is sufficiently small that a manufacturer would have no difficulty in deciding whether his vehicle would be likely to fail if tested by NHTSA.

The provisions of the dummy regulation have been modified somewhat from those proposed in the notice of proposed rulemaking, largely as a result of comments from GM. Minor corrections have been made in the drawings and materials specifications as a result of comments by GM and the principal dummy suppliers. The dummy specification, as finally adopted, reproduces the Hybrid II in each detail of its design and provides, as a calibration check, a series of performance criteria based on the observed performance of normally functioning Hybrid II components. The performance criteria are wholly derivative and are intended to filter out dummy aberrations that escape detection in the manufacturing process or that occur as a result of impact damage. The revisions in the performance criteria, as discussed hereafter, are intended to eliminate potential variances in the test procedures and to hold the performance of the Hybrid II within the narrowest possible range.

General Motors suggested the abandonment of the definition of "upright position" in section 572.4(c), and the substitution of a setp-up procedure in section 572.11 to serve both as a positioning method for the performance tests and as a measurement method for the dummy's dimensions as shown in the drawings. The NHTSA does not object to the use of an expanded set-up procedure, but has decided to retain the term "upright position" with appropriate reference to the new section 572.11(i).

The structural properties test of section 572.5(c), which had proposed that the dummy keep its properties after being subjected to tests producing readings 25 percent above the injury criteria of Standard No. 208, has been revised to provide instead that the properties must be retained after vehicle tests in accordance with Standard No. 208.

The head performance criteria are adopted as proposed. The procedures have been amended to insure that the forehead will be oriented below the nose prior to the drop, to avoid interference from the nose. In response to comments by the Road Research Laboratory, American Motors, and GM, an interval of at least 2 hours between tests is specified to allow full restoration of compressed areas of the head skin.

The neck performance criteria are revised in several respects, in keeping with GM's recommendations. The pendulum impact surface, shown in Figure 4, has been modified in accordance with GM's design. The zero time point has been specified as the instant the pendulum contacts the honeycomb, the instructions for determining chordal displacement have been modified, and the pulse shape of the pendulum deceleration curve has been differently specified. The maximum allowable deceleration for the head has been increased slightly to 26g. In response to suggestions by the Road Research Laboratory and the Japan Automobile Manufacturers Association (JAMA), as well as GM, a tolerance has been specified for the pendulum's impact velocity to allow for minor variances in the honeycomb material.

With respect to the thorax test, each of the minor procedural changes requested by GM has been adopted. As with the head, a minimum recovery time is specified for the thorax. The seating surface is specified in greater detail, and the test probe orientation has been revised to refer to its height above the seating surface. The test probe itself is expressly stated to have a rigid face, by amendment to section 572.11, thereby reflecting the probes actually used by NHTSA and GM. A rigid face for the probe was also requested by Mercedes Benz.

The test procedures for the spine and abdomen tests are specified in much greater detail than before, on the basis of suggestions by GM and others that the former procedures left too much room for variance. The test fixtures for the spinal test orientation proposed by GM, and its proposed method of load application have been adopted. The parts of the dummy to be assembled for these tests are specifically recited, and an initial 50° flexion of the dummy is also specified. The rates of load application and removal, and the method of taking force readings are each specified. The direction of force application is clarified in response to a comment by Volvo.

The abdomen test is amended with respect to the initial point of force measurement, to resolve a particular source of disagreement between GM's data and NHTSA's. The boundaries of the abdominal force-deflection curve are modified to accord with the measurements taken by GM subsequent to the issuance of the notice. The rate of force application is specified as not more than 0.1 inch per second, in response to comments by Mercedes Benz, JAMA, and GM.

The test procedures for the knee tests are revised to specify the type of seating surface used and to control the angle of the lower legs in accordance with suggestions by JAMA, the Road Research Laboratory, and GM. The instrumentation specifications of section 572.11 are amended to clarify the method of attachment and orientation of the thorax accelerometers and to specify the channel classes for the chest potentiometer, the pendulum accelerometer, and the test probe accelerometer, as requested by several comments.

The design and assembly drawings for the test dummy are too cumbersome to publish in the *Federal Register*. During the comment period on the April 2 notice, the agency maintained master copies of the drawings in the docket and placed the reproducible mylar masters from which the copies were made with a commercial blueprint facility from whom interested parties could obtain copies. The NHTSA has decided to continue this practice and is accordingly placing a master set of drawings in the docket and the reproducible masters for these drawings with a blueprint facility.

The drawings as adopted by this notice differ only in minor detail from those that accompanied the April 2 notice. The majority of the changes, incorporated into corrected drawings, have already been given to those persons who ordered copies. The letter of June 13, 1973, that accompanied the corrected drawings has been placed in the docket. The June corrections are incorporated into the final drawing package. Additional adjustments are made hereby to reflect better the weight distribution of separated segments of the dummy, to allow other materials to be used for head ballast, and to specify the instrument for measuring skin thickness. The details of these changes are recited in a memorandum incorporated into the drawing package.

Each of the final drawings is designated by the legend "NHTSA Release 8/1/73". Each

drawing so designated is hereby incorporated as part of the test dummy specifications of 49 CFR Part 572. Subsequent changes in the drawings will not be made without notice and opportunity for comment.

The incorporation of the Part 572 test dummy into Standard No. 208 makes obsolete several test conditions of the standard that had been adopted to supplement the former test dummy specifications. The location, orientation, and sensitivity of test instrumentation formerly specified by sections S8.1.15 through S8.1.18 are now controlled by Part 572 are are no longer necessary within Standard No. 208. Similarly, the use of rubber components for the head, neck and torso joints as specified in Part 572, supplant the joint setting specifications for those joints in section S8.1.10 of the standard. The NHTSA has determined that the deletion of the above portions of the Standard No. 208 will have no effect on the substantive requirements of the standard and that notice and public procedure thereon are unnecessary.

In consideration of the foregoing, Title 49, Code of Federal Regulations, is amended by the addition of Part 572, Anthropomorphic Test Dummy. . . .

In view of the pressing need for a test dummy to permit the continued development of passive restraint systems, and the fact that it presently only relates to a new option for compliance, the NHTSA finds that there is good cause to adopt an immediate effective date. Accordingly, Part 572 is effective August 1, 1973, and the amendment to Standard 208 is effective August 15, 1973.

Issued under the authority of sections 103 and 119 of the National Traffic and Motor Vehicle Safety Act, P.L. 89-563, 15 U.S.C. 1392, 1407, and the delegation of authority at 38 F.R. 12147.

Issued on July 26, 1973.

James E. Wilson
Associate Administrator
Traffic Safety Programs

38 F.R. 20449
August 1, 1973

PREAMBLE TO AMENDMENT TO PART 572—ANTHROPOMORPHIC TEST DUMMIES

(Docket No. 73–8; Notice 4)

This notice amends Part 572, *Anthropomorphic Test Dummy*, to specify several elements of the dummy calibration test procedures and make minor changes in the dummy design specifications. Part 572 is also reorganized to provide for accommodation of dummies other than the 50th-percentile male dummy in the future.

Part 572 (49 CFR Part 572) establishes, by means of approximately 250 drawings and five calibration tests, the exact specifications of a test device that simulates an adult occupant of a motor vehicle, for use in evaluating certain types of crash protection systems provided in accordance with Standard No. 208, *Occupant Crash Protection* (49 CFR § 571.208). Interested persons are advised that NHTSA Docket Nos. 69–7 and 74–14 concerning Standard No. 208 are related to this rulemaking.

Proposed occupant protection requirements in Standard No. 208 were reviewed by the Sixth Circuit in 1972 ("*Chrysler v. Department of Transportation*," 472 F. 2d 659 (6th Cir. 1972)), and the dummy previously specified for use in testing was invalidated as insufficiently objective. The NHTSA subsequently established new dummy specifications under Part 572 for the limited purpose of qualifying passive restraint systems which manufacturers choose to offer on an optional basis (38 FR 20499, August 1, 1973). After examining test experience with the Part 572 dummy, the NHTSA specified its use in a proposal to mandate passive restraint systems (39 FR 10271, March 19, 1974).

Recently, the agency proposed minor changes in calibration procedures and dummy drawings (40 FR 33462, August 8, 1975) in response to the comments of manufacturers and others on the March 1974 notice. The August 1975 proposal only addressed the issue of dummy objectivity raised by the Sixth Circuit, while issues of dummy similarity to humans, sensitivity to test environment, and dummy positioning in a vehicle have been treated elsewhere (41 FR 29715, July 19, 1976).

It is noted that the most recent Department of Transportation proposals on Standard No. 208 (41 FR 24070, June 14, 1976) reflected a modification of performance requirements that reduce the number and types of tests in which the Part 572 dummy would be used in Standard No. 208 dynamic tests. Specifically, rollover and lateral testing would no longer be required if a lap belt were installed in the front seating positions. The NHTSA's July 1976 proposal noted above would conform existing tests in Standard No. 208 to the modified approach. It would also increase the permissible femur force loads that could be registered on the dummy during impact, and restrict femur force requirements to compressive forces. Interested persons should be aware of these significant potential changes in the use of the dummy in Standard No. 208.

As for the dummy objectivity treated by the proposal that underlies this notice, manufacturers' comments stressed the complexity of the test environment in which the device is used and their uncertainty as to how much the dummy characteristics contribute to the variability that is encountered. In somewhat contradictory fashion, several of the manufacturers repeated requests for a "whole systems" calibration of the dummy that would be conducted under conditions approximating the barrier crash whose complex variables had just been emphasized.

As is the case with any measuring instrument, variations in readings can result from imperfection in the instrument or variations in the phenomenon being measured (in this case, the

complex events that occur as a passenger car impacts a barrier at 30 mph, or is impacted laterally by a 4,000-pound moving barrier, or is rolled over). While the "*Chrysler*" court delayed Standard No. 208 so that variation in the dummy's behavior could be corrected, it found the standard (and the dynamic test procedures) practicable and "designed to meet the need for motor vehicle safety" (472 F2d at 674, 675). To meet the need for motor vehicle safety, the dynamic tests are realistic simulations of the actual crash environment. Variations in the precise circumstances to which the dummy is exposed from test to test are expected.

Simulation of such crashes to provide a "whole systems" calibration of the dummy would not be reasonable, however, because of the variations that are inherent in the 30-mph (and the other) impacts. Unless the inputs to the dummy during calibration are precisely controlled, as is the case with the five sub-assembly tests, the "whole systems" calibration would be meaningless. To conduct precisely controlled 30-mph barrier crash tests as part of the dummy calibration procedure would be very expensive, since dummy calibration is normally performed before and after each compliance test. The good results obtained in sub-assembly calibration, and supported by the controlled "whole dummy" test results referred to in the preamble to the proposal, make such a "whole systems" test redundant. The agency concludes that introduction into Part 572 of an extremely expensive and unfamiliar additional calibration is unjustified.

General Motors (GM), Chrysler Corporation, Ford Motor Company, and the Motor Vehicle Manufacturers Association (MVMA) stated that the dummy construction is unsuited to measurements of laterally-imposed force, thereby rendering the dummy unobjective in the "lateral impact environment." While the agency does not agree with these objections, the modified performance levels put forward by the Department of Transportation and the agency would allow manufacturers to install lap belts if they do not wish to undertake lateral or rollover testing. Any manufacturer that is concerned with the objectivity of the dummy in such impacts would provide lap belts at the front seating positions in lieu of conducting the lateral or rollover tests.

Ford and Chrysler argued that the test dummy is insufficiently specified despite the approximately 250 detailed drawings that set forth dummy construction. Their concern seems to be limited to minor contour dimensions that they consider critical to dummy objectivity. To eliminate any such concern the agency will place a specimen of the dummy in the data and drawings package and incorporate it by reference into Part 572.

The MVMA stated that its reading of the docket comments indicated that the dummy cannot be assembled as it is designed. The agency is aware that dimensional tolerances could, at their extremes, "stack up" to cause the need in rare instances for selective fitting of components. Manufacturers can avoid any such problem by reducing the dispersion of tolerances or by select fitting of components to avoid tolerance "stack-up." Of the three dummy manufacturers' comments on this proposal, only Humanoid Systems (Humanoid) listed discrepancies. The agency has reviewed the asserted discrepancies and concludes that the specifications themselves, the manufacturing practices just noted, or the calibration procedures are adequate to resolve the cited problems. To simplify the dummy, certain studs located at the side of the dummy femurs (used for mounting photographic targets and unnecessary to NHTSA test procedures) are deleted because of their potential for reducing repeatability under some circumstances. These studs are designated F/02, G/02, F/25, and G/25.

Bayerische Motorenverken recited test experience that demonstrated different performance characteristics among the products of different dummy manufacturers, although they are all warranted to meet the specifications of the regulations. NHTSA Report DOT-HS-801-861 demonstrates that some manufacturer-warranted dummies did not meet all calibration requirements of Part 572. The agency, however, is not in a position to assume responsibility for the contractual terms established between private parties.

Humanoid noted that experience with the vinyl flesh specification of the dummy led to resolution of aging problems on which it had earlier commented. The company did recommend latitude in vinyl formulation to permit market competi-

tion. General Motors also expressed concern that specification of the Part 572 dummy not stifle innovation. Alderson Research Laboratories (ARL) once again asked that the agency specify a one-piece casting in place of the welded head presently specified. The agency sympathizes with this interest in improvement of the dummy manufacturing techniques. However, the dummy is a test instrument crucial to the validity of an important motor vehicle safety standard and as such, it cannot be loosely described for the benefit of innovation.

Volkswagen requested improvement in aging and in storage techniques for the dummy. The agency considers that it has met its responsibilities by specifying calibration tests that will signal improper storage or age-related changes. Further development in this area is within the province of the manufacturers and users. Significant improvements in aging or storage factors will, of course, not be ignored by the agency.

Although Ford and American Motors Corporation (AMC) made no comment on the specifics of the NHTSA proposal, Chrysler Corporation and several other vehicle manufacturers, as well as the dummy manufacturers, supported the proposed changes. The National Motor Vehicle Safety Advisory Council took no position on the proposal. The Vehicle Equipment Safety Commission did not comment on the proposal. Having carefully reviewed all of the comments submitted and additional data compiled by the agency, the changes are adopted, essentially as proposed. The agency proposed modification of the five calibration procedures for dummy subassemblies, along with minor changes in the drawings that describe all components of the dummy.

HEAD

The head calibration involves dropping the head 10 inches so that its forehead strikes a rigid surface and registers acceleration levels that must fall within a certain range. No comments were received on the small relocation of measurement points or the specification of "instant release" of the head, and these modifications are made as proposed.

The proposal included a specification of 250 microinches (rms) for the finish of the steel plate on which the head is dropped. The agency had considered other factors (particularly friction at the skull-skin interface of the dummy forehead) that might affect the accelerometer readings. It was found that, in most instances, the dummy as received from the manufacturer conformed to the specifications. When deviations were encountered, treatment of the head in accordance with manufacturer recommendations eliminated the effect of these factors on results. Comparison of data on 100 head drop tests conducted since issuance of the proposal confirms that conclusion. Ninety-seven percent of these head drops registered readings within the specified limits, with a mean response value of 232g and a standard deviation of 14g, indicating a coefficient of variance of 6 percent. Of the three failures, the response values were 203g, 204g and 263g. All of the drop tests fell within the specified 0.9- to 1.5-ms time range at the 100g level. The surface finish of the drop plate was 63 microinches (rms). In view of this data, it does not appear necessary to adjust either the response range as advocated by Humanoid or the time range as recommended by Ford. The test results, however, support the request by a number of comments to change the proposed 250-microinch finish to a value below 100 microinches (rms). On the basis of the comments and NHTSA test data, the impact plate surface finish is specified as any value in the range from 8 to 80 microinches (rms).

General Motors asked whether coating of the steel plate is permitted. Coating is permitted so long as the 8- to 80-microinch range for the surface is maintained.

Humanoid recommended that any lubrication or surface smoothness introduced by the dummy manufacturers be made uniform in the interests of component interchange. Volkswagen also recommended a skull-to-skin interface finish specification. The NHTSA, however, does not believe that differing procedures for preparation of the skull-skin interface prevent interchange of the heads, and the requests are therefore not granted.

In view of the agency decision to incorporate by reference a specimen of the Part 572 dummy in the drawings and data package, it is also considered unnecessary to specify, as requested by Humanoid, thickness and performance specification for the headform at 45 and 90 degrees from the midsaggital plane. With regards to Humanoid's view that head drop tests are irrelevant to performance of the dummy as a measuring instrument, the agency considers them closely tied to the characteristics of the dummy that affect its repeatability as a measuring device.

Renault and Peugeot recommended consideration of a revision in the test criteria of Standard No. 208, in the case of safety belts, to replace the limitation on head acceleration with a limitation on submarining. The agency considers the present limit on head acceleration a valuable means to limit head loading and neck hyperflexion in belt systems as well as other systems. It is a requirement that is already being met on a production basis by Volkswagen.

Toyota stated that the 10g limit on lateral acceleration during the head drop would be impossible to satisfy. The NHTSA's own test experience did not exhibit any evidence of the noted problem. None of the manufacturers of dummies objected to the proposal, and Alderson Research Laboratories (ARL) supported the 10g limit. It is therefore made final as proposed.

ARL once more requested consideration of the one-piece headform in place of the welded headform presently specified. If, as ARL states, its customers accept and utilize the one-piece casting, the agency does not understand the necessity to modify the specification. ARL's request for consideration of a one-piece neck bracket is subject to the same response. As earlier noted, the justification to "freeze" the dummy specification is clear from its use as a measurement instrument that is the basis of manufacturer compliance with, and agency verification testing to, a major motor vehicle safety standard.

NECK

Comments generally agreed with the proposed changes in the dummy neck calibration (attachment of the head form to the neck, and attachment of the neck to the end of a pendulum which impacts an energy-absorbing element, inducing head rotation which must fall within specified limits). General Motors clarified that its engineers' reason for recommending a non-articulated neck instead of an articulated neck concerned the cost, maintenance, and complexity of the latter's construction. Volkswagen agreed with Sierra Engineering Company (Sierra) that a smaller tolerance for the pendulum's speed at impact should be considered. Humanoid agreed with the agency's view that the articulated neck does not provide the desired level of repeatability at this time. Having considered these comments the agency makes final the proposed location change for the accelerometers, deletion of § 572.7 (c)(5), and clarification of the "t4" point and the 26g level.

Manufacturers made several additional recommendations. Humanoid expressed support of AMC's view that the neck calibration should be conducted at barrier impact velocity. The agency has reviewed these comments and finds that the specified energy levels are adequate for the intended purpose of establishing dynamic response characteristics and the measurement of repeatability of dummy necks under dynamic test conditions. Testing at higher levels would bring other dummy components besides the neck into direct impact interaction, thereby obscuring or completely masking the measured phenomena.

Volkswagen cautioned against an entirely free selection of damping materials because of variation in rebound characteristics produced with different materials that can achieve conforming deceleration time histories. The agency agrees that a limit on rebound should be established to compliment the choice of damping materials and has added such a specification to the end of the text of § 572.7(b).

Humanoid noted interference in the attachment of the neck bracket to the backplate of the sternothoracic structure, due to the presence of a welding bead. The agency has found no interference in the dummies manufactured by two companies and concludes that the interference must be associated with Humanoid's manufacturing technique.

THORAX

The NHTSA proposed several additional specifications for test probe orientation, dummy seating, and limb positioning for the calibration test. The calibration consists of striking the torso of the seated dummy at two speeds with a specified striker to measure thorax resistance, deflection, and hysteresis characteristics. Comments did not object to the changes and they are incorporated as proposed.

The agency also proposed several changes in the drawings for the thorax sub-assembly of the dummy and, without objection, they are made final in virtually the same form. ARL indicated that four heat seals should be used on the zipper. ARL clarified that the longer socket head cap screw is intended to permit sufficient thread engagement, not more latitude in the ballast configuration as stated in the proposal. Humanoid's request to know the clavicle contours that constitute the Part 572 specification is met by placing the dummy specimen in the drawings and data package as earlier noted. Humanoid and Toyo Kogyo suggested an increase in clavicle strength. The agency's experience with the clavicle since the last consideration of this suggestion has been that all dummies are not significantly susceptible to clavicle breakage. Accordingly, the agency does not consider the modification necessary.

The major suggestion by vehicle and dummy manufacturers was a slight revision of the thorax resistance and deflection values, which must not be exceeded during impact of the chest. The present values (1400 pounds and 1.0 inch at 14 fps, 2100 pounds and 1.6 inches at 22 fps) were questioned by GM, which recommends an increase in both resistance and deflection values to better reflect accurate calibration of a correctly designed dummy. Comparable increases were recommended by Humanoid and Sierra. ARL noted that the present values are extremely stringent.

The agency's experience with calibration of the thorax since issuance of the proposal confirms that a slight increase in values is appropriate, although not the amount of increase recommended by the manufacturers. The values have accordingly been modified to 1450 pounds and 1.1 inches at 14 fps, and 2250 pounds and 1.7 inches at 22 fps. The agency does not set a minimum limit on the value as recommended by General Motors, because the interaction of the deflection and resistance force values make lower limits unnecessary. The changes in values should ease ARL's concern about the seating surface, although the agency's own experience does not indicate that a significant problem exists with the present specifications of the surface.

In conjunction with these changes, the agency has reduced the maximum permissible hysteresis of the chest during impact to 70 percent as recommended by GM.

GM requested a clarification of the dummy limb positioning procedures for purposes of thorax impact testing, citing the possibility of limb misadjustment between steps (1) and (4) of § 572.8(d). The agency has added wording to subparagraph (4) to make clear that the limbs remain horizontally outstretched. The agency does not consider GM's suggested wording to be adequate for calibration. For example, the attitude of the test probe at impact is not specified. For this reason, the requested modification is not undertaken.

Humanoid requested clarification of paragraph (7) of § 572.8(d) that specifies measurement of horizontal deflection "in line with the longitudinal centerline of the probe." Humanoid expressed concern that, as the thorax rotated backwards, the horizontal measurement could not be made. A clarification has been added to the cited language.

Humanoid also requested a less temperature-sensitive rib damping material than is presently employed. The NHTSA concludes that its strict limitation on permissible temperature and humidity conditions for calibration testing adequately controls the effects of temperature on this damping material.

LUMBAR SPINE, ABDOMEN

The NHTSA proposed minor modifications of the lumbar spine construction, and several changes in the procedures for lumbar spine calibration, which consists of spine flexion from the upright position, followed by release of the force which was required to attain this deflection, and measurement of the return angle. Manufacturers supported the majority of the changes, and

they are made final in this notice. The agency proposed that measurements be taken when "flexing has stopped," and Toyota, noting the difficulty of establishing this point under some circumstances, suggested that the measurement be made 3 minutes after release. This modification is reasonable and is included in the final action.

Testing at NHTSA's Safety Research Laboratory demonstrates the need to clarify proposed § 572.9(c)(3) to specify return of the lumbar spine sufficiently so that it remains in "its initial position in accordance with Figure 11" unassisted. An appropriate further specification has been made.

Humanoid requested that the four-bolt attachment of the push plate be revised to two-bolt attachment in view of Humanoid's practice of providing a two-bolt plate. The agency has undertaken its data collection using four-bolt attachment, and to preserve the uncontested validity of these data, declines to modify the proposed specification.

ARL requested reconsideration of NHTSA's decision to leave unchanged the lumbar cable ball and socket attachment design. The agency has continued to examine test results and cannot conclude that the present attachment design has caused a calibration or compliance problem. Accordingly, ARL's request is denied. An ARL request to limit the reference to the strength requirements of the military specification in the case of lumbar cable swaging is granted. If such a limitation were not specified, the other elements of the military specification might arguably be included in the NHTSA's specification.

Calibration of the abdomen of the dummy is accomplished by application of a specified force to the abdomen while the dummy torso is placed on its back, with a required "force/deflection" curve resulting. The proposal added a range of force application rates to make the procedure more uniform, as well as a 10-pound preload and further specification of the horizontal surface. Manufacturers did not oppose these changes.

Manufacturers did oppose the proposed specification changes that would require the dummy abdominal sac to be sealed. Various reasons unrelated to abdomen performance were listed (e.g., transportation of sealed sac in unpressurized aircraft compartment) and available data show successful calibration in both configurations. In view of the expressed preference for the unsealed design, the leak test has been removed from the drawings, and the vent is retained.

Humanoid requested that the shape of the abdominal insert be modified to conform more closely to the dummy's abdominal cavity. The shape of the insert affects the dummy performance, however, and the agency does not consider a change with unknown consequences advisable at this time. The agency also concludes that Humanoid's request to drop all specification of wall thickness for the abdominal sac is also unadvisable for this reason.

Ford, the MVMA, and Humanoid noted an asymmetry of the dummy pelvic castings and requested a justification for it. The asymmetry is apparently an artifact of the adoption of Society of Automotive Engineers specifications, whose origin is unknown. In the agency's judgment, based on experience with numerous Part 572 dummies and evaluation of test results, no degradation in performance is attributable to the asymmetry. While the agency intends to further review the asymmetry noted, no action will be taken without evidence that the specification affects testing.

LIMBS

Little comment was received on the changes proposed for limb calibration, which consists of impacting the knees of a seated dummy with a test probe of a specified weight at a specified speed and measuring the impact force on the dummy femurs. In response to Toyota's request for clarification, the positioning in accordance with § 572.11 is followed by the leg adjustments specified in § 572.10(c), which have the effect of changing leg position from that achieved under § 572.11.

The proposed specification of vinyl skin thickness over the knee face was supported in comments, although two manufacturers requested that the thickness tolerance be moved upward to thicken the skin somewhat. Humanoid did suggest elimination of the femur calibration as useless, but the agency considers such a control important to repeatable performance of the dummy.

Ford interpreted information contained in contract work undertaken for the NHTSA (DOT-HS-4-00873) to show that femur force loads registered too high in 50 percent of cases conducted under the calibration conditions of the standard. In NHTSA tests of 100 dummy knees on Part 572 dummies (DOT-HS-801 861), the 2,500-pound limit was exceeded only twice. The same data indicated a tendency for the femur to register lower than previously estimated, and a minor reduction of the lower limit is established in this action. The agency considers the small reduction to fall within the ambit of the proposal to improve conditions for calibration.

Ford's and Humanoid's observations with regard to off-center impacts that result in bending or torque have been dealt with in the recent agency proposal to limit femur force requirements of Standard No. 208 to compressive force. As for Humanoid's concern that unacceptable variation is possible in the femur load cell, it is noted that General Motors and Volkswagen have both certified thousands of vehicles based on impact readings taken from this dummy with these femur cells installed.

GENERAL TEST CONDITIONS

The agency proposed minor changes in the general test conditions of § 572.11 that apply to dummy test, such as a minimum period of dummy exposure to the temperature and humidity at which calibration tests are conducted. With correction of accelerometer locations, a clarification of dummy positioning, and an increase of zipper heat seals from three to four, the contemplated changes are made as proposed.

Sierra requested a broader range of humidity conditions for the calibration tests, stating that a range of 10- to 90-percent humidity would not affect results of "performance tests." The company cited freezing and desert heat conditions as reasons for a 6-hour conditioning rather than the 4-hour conditioning proposed by the agency. Humanoid and Toyota also addressed this aspect of the general test conditions. It appears that Sierra misunderstood the temperature and humidity specifications as applicable to vehicle performance tests. This rulemaking action addresses only calibration tests which presumably would be conducted indoors in a temperature-controlled setting. Because the dummies are not expected to be stored in areas of great temperature extremes prior to calibration testing, the proposed ranges of humidity and temperature conditions are considered to be effective to stabilize the affected dummy properties. While instrumentation would be affected by the 90-percent humidity condition suggested by Sierra, the agency has reduced the lower humidity condition to a 10-percent level in agreement that the change does not affect the ability to calibrate the dummy.

Sierra objected that a dummy manufacturer's warranty of conformity of its products to Part 572 would be complicated by a time specification for temperature and humidity conditioning. The company believed that its customers would require that 4 hours of conditioning occur whether or not the dummy had already stabilized at the correct temperature. The agency sees no reason why a purchaser would insist on a senseless condition but, in any case, has no control over the contractual dealings between the dummy manufacturer and the purchaser. The NHTSA cannot delete necessary stabilizing conditions from its regulations simply because a purchaser wishes to make an unreasonable contractual specification based on it. The same rationale is responsive to Sierra's request for shorter recovery intervals between repeated tests.

Toyota supplied data to demonstrate that more consistent thorax and knee impact tests could be achieved by using cotton pants on the dummy. The agency's data do not agree with Toyota's and no other manufacturer took issue with the agency's proposal to delete all clothing requirements. This deletion is made final as proposed.

ARL asked why the agency's proposed prohibition against painting dummy components is qualified to state "except as specified in this part or in drawings subtended by this part." This qualification simply preserves the agency's opportunity to specify painted components in the future.

No conclusive evidence of preferable storage methods was submitted by commenters. The agency therefore does not specify that the dummy calibrations be preceded by positioning in a specific posture. To avoid the possibility of introducing a variable, however, the eye bolt in the

dummy head has been relabeled on the drawings as "not for use in suspending dummy in storage."

Interested persons are advised that the first stage of choosing a replacement foaming agent for the specified Nitrosan are complete. Details are available in document HS–802–030 in the public docket.

In accordance with recently enunciated Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 FR 16200, April 16, 1976), the agency herewith summarizes its evaluation of the economic and other consequences of this action on the public and private sectors, including possible loss of safety benefits. The changes made are all to existing specifications and calibration procedures and are intended as clarifications of specifications already established. Therefore, the cost of the changes are calculated as minimal, consisting at most of relatively small modifications of test equipment and minor dummy components. The number and complexity of calibration tests are not affected by the changes. At the same time, the clarification will improve a manufacturer's ability to conduct compliance tests of safety systems and will thereby contribute to an increase in motor vehicle safety.

Note—

The economic and inflationary impacts of this rulemaking have been carefully evaluated in accordance with Office of Management and Budget Circular A–107, and an Inflation Impact Statement is not required.

In anticipation of the use of dummies other than the 50th-percentile male dummy in compliance testing, the agency takes this opportunity to reorganize Part 572 so that the 50th-percentile dummy occupies only one Subpart.

In consideration of the foregoing, 49 CFR Part 572, *Anthropomorphic Test Dummy*, and the dummy design drawings incorporated by reference in Part 572, are amended . . . .

Effective date: August 8, 1977.

(Sec. 103, 119, Pub. L. 89–563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on January 31, 1977.

John W. Snow
Administrator

42 F.R. 7148
February 7, 1977

PREAMBLE TO AMENDMENT TO PART 572—ANTHROPOMORPHIC TEST DUMMIES

(Docket No. 74–14; Notice 11; Docket No. 73–8; Notice 07)

This notice amends occupant crash protection Standard No. 208 and its accompanying test dummy specification to further specify test procedures and injury criteria. The changes are minor in most respects and reflect comments by manufacturers of test dummies and vehicles and the NHTSA's own test experience with the standard and the test dummy.

Date: Effective date—July 5, 1978.

Addresses: Petitions for reconsideration should refer to the docket number and be submitted to: Docket Section, Room 5108, Nassif Building, 400 Seventh Street, S.W., Washington, D.C. 20590.

For further information contact:

Mr. Guy Hunter,
Motor Vehicle Programs,
National Highway Traffic Safety Administration,
Washington, D.C. 20590
(202 426–2265)

Supplementary information: Standard No. 208, *Occupant Crash Protection* (49 CFR 571.208), is a Department of Transportation safety standard that requires manufacturers to provide a means of restraint in new motor vehicles to keep occupants from impacting the vehicle interior in the event a crash occurs. The standard has, since January 1968, required the provision of seat belt assemblies at each seating position in passenger cars. In January 1972 the requirements for seat belts were upgraded and options were added to permit the provision of restraint that is "active" (requiring some action be taken by the vehicle occupant, as in the case of seat belts) or "passive" (providing protection without action being taken by the occupant).

In a separate notice issued today (42 FR 34289; FR Reg. 77–19137), the Secretary of Transportation has reached a decision regarding the future occupant crash protection that must be installed in passenger cars. The implementation of that decision will involve the testing of passive restraint systems in accordance with the test procedures of Standard No. 208, and this notice is intended to make final several modifications of that procedure which have been proposed for change by the NHTSA. This notice also responds to two petitions for reconsideration of rulemaking involving the test dummy that is used to evaluate the compliance of passive restraints systems.

DOCKET 74–14; NOTICE 05

Notice 5 was issued July 15, 1976 (41 FR 29715; July 19, 1976) and proposed that Standard No. 208's existing specification for passive protection in frontal, lateral, and rollover modes (S4.1.2.1) be modified to specify passive protection in the frontal mode only, with an option to provide passive protection or belt protection in the lateral and rollover crash modes. Volkswagen had raised the question of the feasibility of small cars meeting the standard's lateral impact requirements: A 20-mph impact by a 4,000-pound, 60-inch-high flat surface. The agency noted the particular vulnerability of small cars to side impact and the need to provide protection for them based on the weight of other vehicles on the highway, but agreed that it would be difficult to provide passive lateral protection in the near future. Design problems also underlay the proposal to provide a belt option in place of the existing passive rollover requirement.

Ford Motor Company argued that a lateral option would be inappropriate in Standard No. 208 as long as the present dummy is used for

measurement of passive system performance. This question of dummy use as a measuring device is treated later in this notice. General Motors Corporation (GM) supported the option without qualification, noting that the installation of a lap belt with a passive system "would provide comparable protection to lap-shoulder belts in side and rollover impacts." Chrysler did not object to the option, but noted that the lap belt option made the title of S4.1.2.1 ("complete passive protection") misleading. Volkswagen noted that its testing of belt systems without the lap belt portion showed little loss in efficacy in rollover crashes. No other comments on this proposal were received. The existing option S4.1.2.1 is therefore adopted as proposed so that manufacturers will be able to immediately undertake experimental work on passive restraints on an optional basis in conformity with the Secretary's decision.

There were no objections to the agency's proposal to permit either a Type 1 or Type 2 seat belt assembly to meet the requirements, and thus it is made final as proposed.

The NHTSA proposed two changes in the injury criteria of S6 that are used as measures of a restraint system's qualification to Standard No. 208. One change proposed an increase in permissible femur force limits from 1,700 pounds to 2,250 pounds. As clarification that tension loads are not included in measurement of these forces, the agency also proposed that the word "compressive" be added to the text of S6.4. Most commenters were cautionary about the changes, pointing out that susceptibility to fracture is time dependent, that acetabular injury could be exacerbated by increased forces, and that angular applications of force were as likely in the real world as axial forces and would more likely fracture the femur.

The agency is aware of and took into account these considerations in proposing the somewhat higher femur force limit. The agency started with the actual field experience of occupants of GM and Volkswagen vehicles that have been shown to produce femur force readings of about 1,700 pounds. Occupants of these vehicles involved in crashes have not shown a significant incidence of femur fracture. The implication from this experience that the 1,700-pound figure can safely be raised somewhat is supported in work by Patrick on compressive femur forces of relatively long duration. The Patrick data (taken with aged embalmed cadavers) indicate that the average fracture load of the patella-femur-pelvis complex is 1,910 pounds. This average is considered conservative, in that cadaver bone structure is generally weaker than living human tissues. While these data did not address angular force applications, the experience of the GM and Volkswagen vehicle occupants does suggest that angular force application can go higher than 1,700 pounds.

The agency does not agree that the establishment of the somewhat higher outer limit for permissible femur force loads of 2,250 pounds is arbitrary. What is often ignored by the medical community and others in commenting on the injury criteria found in motor vehicle safety standards is that manufacturers must design their restraint systems to provide greater protection than the criteria specified, to be certain that each of their products will pass compliance tests conducted by the NHTSA. It is a fact of industrial production that the actual performance of some units will fall below nominal design standards (for quality control and other reasons). Volkswagen made precisely this point in its comments. Because the National Traffic and Motor Vehicle Safety Act states that each vehicle must comply (15 U.S.C. §1392(a)(1)(a)), manufacturers routinely design in a "compliance margin" of superior performance. Thus, it is extremely unlikely that a restraint system designed to meet the femur force load criterion of 2,250 pounds will in fact be designed to provide only that level of performance. With these considerations in mind, the agency makes final the changes as proposed.

While not proposed for change, vehicle manufacturers commented on a second injury criterion of the standard: A limitation of the acceleration experienced by the dummy thorax during the barrier crash to 60g, except for intervals whose cumulative duration is not more than 3 milliseconds (ms). Until August 31, 1977, the agency has specified the Society of Automotive Engi-

neers' (SAE) "severity index" as a substitute for the 60g–3ms limit, because of greater familiarity of the industry with that criterion.

General Motors recommended that the severity index be continued as the chest injury criterion until a basis for using chest deflection is developed in place of chest acceleration. GM cited data which indicate that chest injury from certain types of blunt frontal impact is a statistically significant function of chest deflection in humans, while not a function of impact force or spinal acceleration. GM suggested that a shift from the temporary severity index measure to the 60g–3ms measurement would be wasteful, because there is no "strong indication" that the 60g–3ms measurement is more meaningful than the severity index, and some restraint systems have to be redesigned to comply with the new requirement.

Unlike GM, Chrysler argued against the use of acceleration criteria of either type for the chest, and rather advocated that the standard be delayed until a dummy chest with better deflection characteristics is developed.

The Severity Index Criterion allows higher loadings and therefore increases the possibility of adverse effects on the chest. It only indirectly limits the accelerations and hence the forces which can be applied to the thorax. Acceleration in a specific impact environment is considered to be a better predictor of injury than the Severity Index.

NHTSA only allowed belt systems to meet the Severity Index Criterion of 1,000 instead of the 60g–3ms criterion out of consideration for leadtime problems, not because the Severity Index Criterion was considered superior. It is recognized that restraint systems such as lap-shoulder belts apply more concentrated forces to the thorax than air cushion restraint, and that injury can result at lower forces and acceleration levels. It is noted that the Agency is considering rulemaking to restrict forces that may be applied to the thorax by the shoulder belt of any seat belt assembly (41 FR 54961; December 16, 1976).

With regard to the test procedures and conditions that underlie the requirements of the standard, the agency proposed a temperature range for testing that would be compatible with the temperature sensitivity of the test dummy. The test dummy specification (Part 572, "*Anthropomorphic Test Dummy*," 49 CFR Part 572) contains calibration tests that are conducted at any temperature between 66° and 78° F. This is because properties of lubricants and nonmetallic parts used in the dummy will change with large temperature changes and will affect the dummy's objectivity as a test instrument. It was proposed that the Standard No. 208 crash tests be conducted within this temperature range to eliminate the potential for variability.

The only manufacturers that objected to the temperature specification were Porsche, Bayerische Motoren Werke (BMW), and American Motors Corporation (AMC). In each case, the manufacturers noted that dynamic testing is conducted outside and that it is unreasonable to limit testing to the few days in the year when the ambient temperature would fall within the specified 12-degree range.

The commenters may misunderstand their certification responsibilities under the National Traffic and Motor Vehicle Safety Act. Section 108(b)(2) limits a manufacturer's responsibility to the exercise of "due care" to assure compliance. The NHTSA has long interpreted this statutory "due care" to mean that the manufacturer is free to test its products in any fashion it chooses, as long as the testing demonstrates that due care was taken to assure that, if tested by NHTSA as set forth in the standard, the product would comply with the standard's requirements. Thus, a manufacturer could conduct testing on a day with temperatures other than those specified, as long as it could demonstrate through engineering calculations or otherwise, that the difference in test temperatures did not invalidate the test results. Alternatively, a manufacturer might choose to perform its preparation of the vehicle in a temporarily erected structure (such as a tent) that maintains a temperature within the specified range, so that only a short exposure during acceleration to the barrier would occur in a higher or lower temperature. To assist any such arrangements, the test temperature condition has been limited to require a stabilized temperature of the test dummy only, just prior to the vehicle's travel toward the barrier.

In response to an earlier suggestion from GM, the agency proposed further specificity in the clothing worn by the dummy during the crash test. The only comment was filed by GM, which argued that any shoe specification other than weight would be unrelated to dummy performance and therefore should not be included in the specification. The agency disagrees, and notes that the size and shape of the heel on the shoe can affect the placement of the dummy limb within the vehicle. For this reason, the clothing specifications are made final as proposed, except that the requirement for a conforming "configuration" has been deleted.

Renault and Peugeot asked for confirmation that pyrotechnic pretensioners for belt retractors are not prohibited by the standard. The standard's requirements do not specify the design by which to provide the specified protection, and the agency is not aware of any aspect of the standard that would prohibit the use of pretensioning devices, as long as the three performance elements are met.

With regard to the test dummy used in the standard, the agency proposed two modifications of Standard No. 208: a more detailed positioning procedure for placement of the dummy in the vehicle prior to the test, and a new requirement that the dummy remain in calibration without adjustment following the barrier crash. Comments were received on both aspects of the proposal.

The dummy positioning was proposed to eliminate variation in the conduct of repeatable tests, particularly among vehicles of different sizes. The most important proposed modification was the use of only two dummies in any test of front seat restraints, whether or not the system is designed for three designated seating positions. The proposal was intended to eliminate the problem associated with placement of three 50th-percentile male dummies side-by-side in a smaller vehicle. In bench seating with three positions, the system would have to comply with a dummy at the driver's position and at either of the other two designated seating positions.

GM supported this change, but noted that twice as many tests of 3-position bench-seat vehicles would be required as before. The company suggested using a simulated vehicle crash as a means to test the passive restraint at the center seat position. The agency considers this approach unrepresentative of the actual crash pulse and vehicle kinematic response (e.g., pitching, yawing) that occur during an impact. To the degree that GM can adopt such an approach in the exercise of "due care" to demonstrate that the center seating position actually complies, the statute does not prohibit such a certification approach.

Ford objected that the dummy at the center seat position would be placed about 4 inches to the right of the center of the designated seating position in order to avoid interference with the dummy at the driver's position. While the NHTSA agrees that a small amount of displacement is inevitable in smaller vehicles, it may well occur in the real world also. Further, the physical dimensions of the dummy preclude any other positioning. With a dummy at the driver's position, a dummy at the center position cannot physically be placed in the middle of the seat in all cases. In view of these realities, the agency makes final this aspect of the dummy positioning as proposed.

GM suggested the modification of other standards to adopt "2-dummy" positioning. The compatibility among dynamic tests is regularly reviewed by the NHTSA and will be again following this rulemaking action. For the moment, however, only those actions which were proposed will be acted on.

As a general matter with regard to dummy positioning, General Motors found the new specifications acceptable with a few changes. GM cautioned that the procedure might not be sufficiently reproducible between laboratories, and Chrysler found greater variation in positioning with the new procedures than with Chrysler's own procedures. The agency's use of the procedure in 15 different vehicle models has shown consistently repeatable results, as long as a reasonable amount of care is taken to avoid the effect of random inputs (see "Repeatability of Set Up and Stability of Anthropometric Landmarks and Their Influence on Impact Response of Automotive Crash Test Dummies." Society of Automotive Engineers, Technical Paper No. 770260, 1977). The agency concludes that, with the

minor improvements cited below, the positioning procedure should be made final as proposed.

The dummy is placed at a seating position so that its midsagittal plane is vertical and longitudinal. Volkswagen argued against use of the midsagittal plane as a reference for dummy placement, considering it difficult to define as a practical matter during placement. The agency has used plane markers and plane lines to define the midsagittal plane and has experienced no significant difficulty in placement of the dummy with these techniques. For this reason, and because Volkswagen suggested no simpler orientation technique, the agency adopts use of the midsagittal plane as proposed.

Correct spacing of the dummy's legs at the driver position created the largest source of objections by commenters. Ford expressed concern that an inward-pointing left knee could result in unrealistically high femur loads because of femur-to-steering column impacts. GM asked that an additional 0.6 inch of space be specified between the dummy legs to allow for installation of a device to measure steering column displacement. Volkswagen considered specification of the left knee bolt location to be redundant in light of the positioning specification for the right knee and the overall distance specification between the knees of 14.5 inches.

The commenters may not have understood that the 14.5- and 5.9-inch dimensions are only initial positions, as specified in S8.1.11.1.1. The later specification to raise the femur and tibia centerlines "as close as possible to vertical" without contacting the vehicle shifts the knees from their initial spacing to a point just to the left and right of the steering column.

As for GM's concern about instrumentation, the agency does not intend to modify this positioning procedure to accommodate instrumentation preferences not required for the standard's purposes. GM may, of course, make test modifications so long as it assures, in the exercise of due care, that its vehicles will comply when tested in accordance with the specification by the agency.

In the case of a vehicle which is equipped with a front bench seat, the driver dummy is placed on the bench so that its midsagittal plane intersects the center point of the plane described by the steering wheel rim. BMW pointed out that the center plane of the driver's seating position may not coincide with the steering wheel center and that dummy placement would therefore be unrealistic. Ford believed that the specification of the steering wheel reference point could be more precisely specified.

The agency believes that BMW may be describing offset of the driver's seat from the steering wheel in bucket-seat vehicles. In the case of bench-seat vehicles, there appears to be no reason not to place the dummy directly behind the steering wheel. As for the Ford suggestion, the agency concludes that Ford is describing the same point as the proposal did, assuming, as the agency does, that the axis of the steering column passes through the center point described. The Ford description does have the effect of moving the point a slight distance laterally, because the steering wheel rim upper surface is somewhat higher than the plane of the rim itself. This small distance is not relevant to the positioning being specified and therefore is not adopted.

In the case of center-position dummy placement in a vehicle with a drive line tunnel, Ford requested further specification of left and right foot placement. The agency has added further specification to make explicit what was implicit in the specifications proposed.

Volkswagen suggested that the NHTSA had failed to specify knee spacing for the passenger side dummy placement. In actuality, the specification in S8.1.11.1.2 that the femur and tibia centerlines fall in a vertical longitudinal plane has the effect of dictating the distance between the passenger dummy knees.

The second major source of comments concerned the dummy settling procedure that assures uniformity of placement on the seat cushion and against the seat back. Manufacturers pointed out that lifting the dummy within the vehicle, particularly in small vehicles and those with no rear seat space, cannot be accomplished easily. While the NHTSA recognizes that the procedure is not simple, it is desirable to improve the uniformity of dummy response and it has been accomplished by the NHTSA in several small cars (e.g., Volkswagen Rabbit, Honda Civic, Fiat

Spider, DOT HS-801-754). Therefore, the requests of GM and Volkswagen to retain the method that does not involve lifting has been denied. In response to Renault's question, the dummy can be lifted manually by a strap routed beneath the buttocks. Also, Volkswagen's request for more variability in the application of rearward force is denied because, while difficult to achieve, it is desirable to maintain uniformity in dummy placement. In response to the requests of several manufacturers, the location of the 9-square-inch push plate has been raised 1.5 inches, to facilitate its application to all vehicles.

Volkswagen asked with regard to S10.2.2 for a clarification of what constitutes the "lumbar spine" for purposes of dummy flexing. This refers to the point on the dummy rear surface at the level of the top of the dummy's rubber spine element.

BMW asked the agency to reconsider the placement of the driver dummy's thumbs over the steering wheel rim because of the possibility of damage to them. The company asked for an option in placing the hands. The purpose of the specification in dummy positioning, however, is to remove discretion from the test personnel, so that all tests are run in the same fashion. An option under these circumstances is therefore not appropriate.

Ultrasystems, Inc., pointed out two minor errors in S10.3 that are hereby corrected. The upper arm and lower arm centerlines are oriented as nearly as possible in a vertical plane (rather than straight up in the vertical), and the little finger of the passenger is placed "barely in contact" with the seat rather than "tangent" to it.

Two corrections are made to the dummy positioning procedure to correct obvious and unintended conflicts between placement of the dummy thighs on the seat cushion and placement of the right leg and foot on the acceleration pedal.

In addition to the positioning proposed, General Motors suggested that positioning of the dummy's head in the fore-and-aft axis would be beneficial. The agency agrees and has added such a specification at the end of the dummy settling procedure.

In a matter separate from the positioning procedure, General Motors, Ford, and Renault requested deletion of the proposed requirement that the dummy maintain proper calibration following a crash test without adjustment. Such a procedure is routine in test protocols and the agency considered it to be a beneficial addition to the standard to further demonstrate the credibility of the dummy test results. GM, however, has pointed out that the limb joint adjustments for the crash test and for the calibration of the lumber bending test are different, and that it would be unfair to expect continued calibration without adjustment of these joints. The NHTSA accepts this objection and, until a means for surmounting this difficulty is perfected, the proposed change to S8.1.8 is withdrawn.

In another matter unrelated to dummy positioning, Volkswagen argued that active belt systems should be subject to the same requirements as passive belt systems, to reduce the cost differential between the compliance tests of the two systems. As earlier noted the NHTSA has issued an advance Notice of Proposed Rulemaking (41 FR 54961, December 16, 1976) on this subject and will consider Volkswagen's suggestion in the context of that rulemaking.

Finally, the agency proposed the same belt warning requirements for belts provided with passive restraints as are presently required for active belts. No objections to the requirement were received and the requirement is made final as proposed. The agency also takes the opportunity to delete from the standard the out-of-date belt warning requirements contained in S7.3 of the standard.

RECONSIDERATION OF DOCKET 73-8; NOTICE 04

The NHTSA has received two petitions for reconsideration of recent amendments in its test dummy calibration test procedures and design specifications (Part 572, "*Anthropomorphic Test Dummy*," 49 CFR Part 572). Part 572 establishes, by means of approximately 250 drawings and five calibration tests, the exact specifications of the test device referred to earlier in this notice that simulates the occupant of a motor vehicle for crash testing purposes.

Apart from requests for a technical change of the lumbar flexion force specifications, the petitions from General Motors and Ford contained a repetition of objections made earlier in the rulemaking about the adequacy of the dummy as an objective measuring device. Three issues were raised: lateral response characteristics of the dummy, failure of the dummy to meet the five subassembly calibration limits, and the need for a "whole systems" calibration of the assembled dummy. Following receipt of these comments, the agency published notification in the *Federal Register* that it would entertain any other comments on the issue of objectivity (42 FR 28200; June 2, 1977). General comments were received from Chrysler Corporation and American Motors, repeating their positions from earlier comments that the dummy does not qualify as objective.

The objectivity of the dummy is at issue because it is the measuring device that registers the acceleration and force readings specified by Standard No. 208 during a 30-mph impact of the tested vehicle into a fixed barrier. The resulting readings for each vehicle tested must remain below a certain level to constitute compliance. Certification of compliance by the vehicle manufacturer is accomplished by crash testing representative vehicles with the dummy installed. Verification of compliance by the NHTSA is accomplished by crash testing one or more of the same model vehicle, also with a test dummy installed. It is important that readings taken by different dummies, or by the same dummy repeatedly, accurately reflect the forces and accelerations that are being experienced by the vehicle during the barrier crash. This does not imply that the readings produced in tests of two vehicles of the same design must be identical. In the real world, in fact, literally identical vehicles, crash circumstances, and test dummies are not physically attainable.

It is apparent from this discussion that an accurate reflection of the forces and accelerations experienced in nominally identical vehicles does not depend on the specification of the test dummy alone. For example, identically specified and responsive dummies would not provide identical readings unless reasonable care is exercised in the preparation and placement of the dummy. Such care is analogous to that exercised in positioning a ruler to assure that it is at the exact point where a measurement is to commence. No one would blame a ruler for a bad measurement if it were carelessly placed in the wrong position.

It is equally apparent that the forces and accelerations experienced in nominally identical vehicles will only be identical by the greatest of coincidence. The small differences in body structure, even of mass-produced vehicles, will affect the crash pulse. The particular deployment speed and shape of the cushion portion of an inflatable restraint system will also affect results.

All of these factors would affect the accelerations and forces experienced by a human occupant of a vehicle certified to comply with the occupant restraint standard. Thus, achievement of identical conditions is not only impossible (due to the inherent differences between tested vehicles and underlying conditions) but would be unwise. Literally identical tests would encourage the design of safety devices that would not adequately serve the variety of circumstances encountered in actual crash exposure.

At the same time, the safety standards must be "stated in objective terms" so that the manufacturer knows how its product will be tested and under what circumstances it will have to comply. A complete lack of dummy positioning procedures would allow placement of the dummy in any posture and would make certification of compliance virtually impossible. A balancing is provided in the test procedures between the need for realism and the need for objectivity.

The test dummy also represents a balancing between realism (biofidelity) and objectivity (repeatability). One-piece cast metal dummies could be placed in the seating positions and instrumented to register crash forces. One could argue that these dummies did not act at all like a human and did not measure what would happen to a human, but a lack of repeatability could not be ascribed to them. At the other end of the spectrum, an extremely complex and realistic surrogate could be substituted for the existing Part 572 dummy, which would act realistically but differently each time, as one might expect different humans to do.

The existing Part 572 dummy represents 5 years of effort to provide a measuring instrument that is sufficiently realistic and repeatable to serve the purposes of the crash standard. Like any measuring instrument, it has to be used with care. As in the case of any complex instrumentation, particular care must be exercised in its proper use, and there is little expectation of literally identical readings.

The dummy is articulated, and built of materials that permit it to react dynamically, similarly to a human. It is the dynamic reactions of the dummy that introduce the complexity that makes a check on repeatability desirable and necessary. The agency therefore devised five calibration procedures as standards for the evaluation of the important dynamic dummy response characteristics.

Since the specifications and calibration procedures were established in August 1973, a substantial amount of manufacturing and test experience has been gained in the Part 572 dummy. The quality of the dummy as manufactured by the three available domestic commercial sources has improved to the point where it is the agency's judgment that the device is as repeatable and reproducible as instrumentation of such complexity can be. As noted, GM and Ford disagree and raised three issues with regard to dummy objectivity in their petitions for reconsideration.

Lateral response characteristics. Recent sled tests of the Part 572 dummy in lateral impacts show a high level of repeatability from test to test and reproducibility from one dummy to another ("Evaluation of Part 572 Dummies in Side Impacts"—DOT HS 020 858). Further modification of the lateral and rollover passive restraint requirements into an option that can be met by installation of a lap belt makes the lateral response characteristics of the dummy largely academic. As noted in Notice 4 of Docket 73–8 (42 FR 7148; February 7, 1977), "Any manufacturer that is concerned with the objectivity of the dummy in such [lateral] impacts would provide lap belts at the front seating positions in lieu of conducting the lateral or rollover tests."

While the frontal crash test can be conducted at any angle up to 30 degrees from perpendicular to the barrier face, it is the agency's finding that the lateral forces acting on the test instrument are secondary to forces in the midsagittal plane and do not operate as a constraint on vehicle and restraint design. Compliance tests conducted by NHTSA to date in the 30-degree oblique impact condition have consistently generated similar dummy readings. In addition, they are considerably lower than in perpendicular barrier impact tests, which renders them less critical for compliance certification purposes.

Repeatability of dummy calibration. Ford questioned the dummy's repeatability, based on its analysis of "round-robin" testing conducted in 1973 for Ford at three differeent test laboratories (Ford Report No. ESRO S–76–3 (1976)) and on analysis of NHTSA calibration testing of seven test dummies in 1974 (DOT–HS–801–861).

In its petition for reconsideration, Ford equated dummy objectivity with repeatability of the calibration test results and concluded "it is impracticable to attempt to meet the Part 572 component calibration requirements with test dummies constructed according to the Part 572 drawing specifications."

The Ford analysis of NHTSA's seven dummies showed only 56 of 100 instances in which all of the dummy calibrations satisfied the criteria. The NHTSA's attempts to reproduce the Ford calculations to reach this conclusion were unsuccessful, even after including the HO3 dummy with its obviously defective neck. This neck failed badly 11 times in a row, and yet Ford apparently used these tests in its estimate of 56 percent compliance. This is the equivalent of concluding that the specification for a stop watch is inadequate because of repeated failure in a stop watch with an obviously defective part. In this case, the calibration procedure was doing precisely its job in identifying the defective part by demonstrating that it did not in fact meet the specification.

The significance of the "learning curve" for quality control in dummy manufacture is best understood by comparison of three sets of dummy calibration results in chronological order. Ford in earlier comments relied on its own "round-robin" crash testing, involving nine test dummies. Ford stated that none of the nine dummies could pass all of the component calibration require-

ments. What the NHTSA learned through follow-up questions to Ford was that three of the nine dummies were not built originally as Part 572 dummies, and that the other six were not fully certified by their manufacturers as qualifying as Part 572 dummies. In addition, Ford instructed its contractors to use the dummies as provided whether or not they met the Part 572 specifications.

In contrast, recent NHTSA testing conducted by Calspan (DOT–HS–6–01514, May and June 1977 progress reports) and the results of tests conducted by GM (USG 1502, Docket 73–8, GR 64) demonstrate good repeatability and reproducibility of dummies. In the Calspan testing a total of 152 calibration tests were completed on four dummies from two manufacturers. The results for all five calibration tests were observed to be within the specified performance criteria of Part 572. The agency concludes that the learning curve in the manufacturing process has reached the point where repeatability and reproducibility of the dummy has been fully demonstrated.

Interestingly, Ford's own analysis of its round-robin testing concludes that variations among the nine dummies were not significant to the test results. At the same time, the overall acceleration and force readings did vary substantially. Ford argued that this showed unacceptable variability of the test as a whole, because they had used "identical" vehicles for crash testing. Ford attributed the variations in results to "chance factors," listing as factors placement of the dummy, postural changes during the ride to the barrier, speed variations, uncertainty as to just what part of the instrument panel or other structure would be impact loaded, instrumentation, and any variations in the dynamics of air bag deployment from one vehicle to another.

The agency does not consider these to be uncontrolled factors since they can be greatly reduced by carefully controlling test procedures. In addition, they are not considered to be unacceptable "chance factors" that should be eliminated from the test. The most important advantage of the barrier impact test is that it simulates with some realism what can be experienced by a human occupant, while at the same time limiting variation to achieve repeatability. As discussed, nominally identical vehicles are not in fact identical, the dynamics of deployment will vary from vehicle to vehicle, and humans will adopt a large number of different seated positions in the real world. The 30-mph barrier impact requires the manufacturer to take these variables into account by providing adequate protection for more than an overly structured test situation. At the same time, dummy positioning is specified in adequate detail so that the manufacturer knows how the NHTSA will set up a vehicle prior to conducting compliance test checks.

"Whole systems" calibration. Ford and GM both suggested a "whole systems" calibration of of the dummy as a necessary additional check on dummy repeatability. The agency has denied these requests previously, because the demonstrated repeatability and reproducibility of Part 572 dummies based on current specification is adequate. The use of whole systems calibration tests as suggested would be extremely expensive and would unnecessarily complicate compliance testing.

It is instructive that neither General Motors nor Ford has been specific about the calibration tests they have in mind. Because of the variables inherent in a high energy barrier crash test at 30 mph, the agency judges that any calibration readings taken on the dummy would be overwhelmed by the other inputs acting on the dummy in this test environment. The Ford conclusion from its round-robin testing agrees that dummy variability is a relatively insignificant factor in the total variability experienced in this type of test.

GM was most specific about its concern for repeatability testing of the whole dummy in its comments in response to Docket 74–14; Notice 01:

> Dummy whole body response requirements are considered necessary to assure that a dummy, assembled from certified components, has acceptable response as a completed structure. Interactions between coupled components and subsystems must not be assumed acceptable simply because the components themselves have been certified. Variations in coupling may lead to significant variation in dummy response.

There is a far simpler, more controlled means to assure oneself of correct coupling of components than by means of a "whole systems" calibration. If, for example, a laboratory wishes to assure itself that the coupling of the dummy neck structure is properly accomplished, a simple statically applied input may be made to the neck prior to coupling to obtain a sample reading, and then the same simple statically applied input may be repeated after the coupling has been completed. This is a commonly accepted means to assure that "bolting together" the pieces is properly accomplished.

Lumbar spine flexion. The flexibility of the dummy spine is specified by means of a calibration procedure that involves bending the spine through a forward arc, with specified resistance to the bending being registered at specified angles of the bending arc. The dummy's ability to flex is partially controlled by the characteristics of the abdominal insert. In Notice 04, the agency increased the level of resistance that must be registered, in conjunction with a decision not to specify a sealed abdominal sac as had been proposed. Either of these dummy characteristics could affect the lumbar spine flexion performance.

Because of the agency's incomplete explanation for its actions, Ford and General Motors petitioned for reconsideration of the decision to take one action without the other. Both companies suggested that the specification of resistance levels be returned to that which had existed previously. The agency was not clear that it intended to go forward with the stiffer spine flexion performance, quite apart from the decision to not specify an abdomen sealing specification. The purpose for the "stiffer" spine is to attain more consistent torso return angle and to assure better dummy stability during vehicle acceleration to impact speed.

To assure itself of the wisdom of this course of action, the agency has performed dummy calibration tests demonstrating that the amended spine flexion and abdominal force deflection characteristics can be consistently achieved with both vented and unvented abdominal inserts (DOT HS-020875 (1977)).

Based on the considered analysis and review set forth above, the NHTSA denies the petitions of General Motors and Ford Motor Company for further modification of the test dummy specification and calibration procedures for reasons of test dummy objectivity.

In consideration of the foregoing, Standard No. 208 (49 CFR 571.208) is amended as proposed with changes set forth below, and Part 572 (49 CFR Part 572) is amended by the addition of a new sentence at the end of § 572.5, *General Description*, that states: "A specimen of the dummy is available for surface measurements, and access can be arranged through: Office of Crashworthiness, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590."

In accordance with Department of Transportation policy encouraging adequate analysis of the consequences of regulatory action (41 FR 16200; April 16, 1976), the Department has evaluated the economic and other consequences of this amendment on the public and private sectors. The modifications of an existing option, the simplification and clarification of test procedures, and the increase in femur force loads are all judged to be actions that simplify testing and make it less expensive. It is anticipated that the "two dummy" positioning procedure may occasion additional testing expense in some larger vehicles, but not the level of expense that would have general economic effects.

The effective date for the changes has been established as one year from the date of publication to permit Volkswagen, the only manufacturer presently certifying compliance of vehicles using these test procedures, sufficient time to evaluate the effect of the changes on the compliance of its products.

The program official and lawyer principally responsible for the development of this amendment are Guy Hunter and Tad Herlihy, respectively.

(Sec. 103, 119, Pub. L. 89-563, 80 Stat. 718 (15 U.S.C. 1392, 1407); delegation of authority at 49 CFR 1.50.)

Issued on June 30, 1977.

Joan Claybrook
Administrator

42 F.R. 34299
July 5, 1977

PREAMBLE TO AMENDMENT TO PART 572—ANTHROPOMORPHIC TEST DUMMIES REPRESENTING SIX-MONTH-OLD AND THREE-YEAR-OLD CHILDREN

(Docket No. 78-09; Notice 4)

ACTION: Final rule.

SUMMARY: This notice is issued in conjunction with new Standard No. 213, *Child Restraint Systems,* which requires child restraint systems to be dynamically tested using anthropomorphic test dummies representing 6-month-old and 3-year-old children. This notice establishes the specifications for the dummies to be used in the child restraint testing. In addition, it sets performance criteria as calibration checks to assure the repeatability of the dummy's performance.

DATES: The amendment is effective upon publication in the Federal Register. December 27, 1979.

ADDRESSES: Petitions for reconsideration should refer to the docket number and be submitted to: Docket Section, Room 5108, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590
(202-426-2264)

SUPPLEMENTARY INFORMATION:

This notice amends Part 572, *Anthropomorphic Test Dummies,* to establish specifications and performance requirements for two test dummies, one representing a 6-month-old child and the other representing a 3-year-old child. This final rule is issued to supplement new Standard No. 213, *Child Restraint Systems,* published in the *Federal Register* for December 13, 1979 (44 FR 72131). Standard No. 213 evaluates the performance of child restraints in dynamic sled tests using the anthropomorphic test dummies whose specifications are established in this final rule. Restraints recommended for children weighing 20 pounds or less will be tested with an anthropomorphic dummy representing a 6-month-old child and restraints recommended for children weighing more than 20 pounds, but not more than 50 pounds will be tested with an anthropomorphic dummy representing a 3-year-old child.

On May 18, 1978, NHTSA published a notice of proposed rulemaking for the anthropomorphic test dummy amendment (43 FR 21490) and the child restraint standard (43 FR 21470). The comment closing date for both notices was December 1, 1978. The May 18, 1978, proposal on the anthropomorphic dummies noted that the calibration requirements proposed for the 3-year-old child test dummy were tentative. The agency said it would continue further testing on the calibrations and the results of that work would be placed in the public docket as soon as possible after the testing was completed. Based on the testing, NHTSA tentatively decided to make several minor modifications to the test dummy specifications and calibration requirements to improve the accuracy of the test dummy as a tool for measuring the performance of child restraints. A copy of the modifications was placed in the public docket on September 27, 1978, and the dummy manufacturers and child restraint testing facilities were advised of the modifications. The tentative modifications were published in the *Federal Register* on November 16, 1978 (43 FR 53478).

At the request of the Juvenile Products Manufacturers Association, the agency extended the comment closing date until January 5, 1979, for the portions of the child restraint and test dummy proposals dealing with testing with the anthropomorphic dummies. NHTSA granted the extension because manufacturers were reportedly having problems obtaining the proposed test

dummies to conduct their own evaluations. Based on information gathered by the agency about the availability of testing facilities and dummies, the agency concluded that manufacturers could conduct the necessary testings before the extended comment closing date.

On December 21, 1978, NHTSA made available one of the agency's test dummies to General Motors Corp. (GM) for the purpose of resolving certain calibration problems GM reported it had experienced with its own test dummy. All other interested parties also were advised of the availability of the NHTSA test dummy and informed that NHTSA did not plan to issue a final rule on the test dummy proposal until at least mid-summer. The agency said it would review additional testing material submitted to the docket before issuance of the final rule. The final rule issuance date was subsequently rescheduled for October 1979 in the Department's March 1, 1979, Semi-Annual Regulations Agenda (44 FR Part II, 38) and for November 1979 in the August 27, 1979 Agenda (44 FR 50195).

Following issuance of the May 1978 notice of proposed rulemaking, NHTSA conducted additional testing of the test dummies. This testing, completed in July 1979, further confirmed the results of the agency's prior testing which showed the anthropomorphic dummies to be objective test devices. The results of this testing were periodically placed in the public docket so that all interested parties could comment on them.

This final rule is based on the data obtained in the agency's testing, data submitted in the comments, and data obtained from other pertinent documents and test reports. Significant comments submitted to the docket are addressed below.

Infant Test Dummy

The infant test dummy is based on a simple design representing the dimensions and mass distribution characteristics of a 6-month-old child. The test dummy is used to assess the ability of infant restraints to retain their occupants and maintain their structural integrity during dynamic testing. Because of its construction, the dummy cannot be instrumented to measure the forces that would be exerted upon an infant in a crash. NHTSA's tests have shown the infant dummy will reliably and consistently represent the dynamics of an infant during simulated impact tests.

GM, the only party to comment on the specification for the infant test dummy, reported that it had "no significant problem in building or verifying the compliance of the dummy to the proposed specification." To improve the durability of the test dummy, GM recommended adding a wooden form to the head to maintain its geometry and using steel instead of lead for ballast in the test dummy. Since these recommendations should not affect the dummy's performance and should increase its durability, NHTSA has adopted a modified version of the proposed changes. The changes add a plastic form to the dummy's head, since a plastic form is easier to manufacture and duplicate than a wooden form. In addition, a portion of the ballast materials are now required to be steel and aluminum.

The revised design drawings and a construction manual for the infant dummy are available for examination in the NHTSA docket section, which is open from 7:45 a.m. to 4:15 p.m., Monday through Friday. Copies of these documents can be obtained from: Keuffel and Esser Co., 1512 North Danville Street, Arlington, Virginia 22201.

3-Year-Old Child Test Dummy

The test dummy representing a 3-year-old child is based on the Alderson Model VIP–3C test dummy. It was chosen over the other available test dummies representing a 3-year-old child, such as the Sierra 492–03 test dummy, because it has more complete design details, can adequately withstand the test load imposed during impact testing, has more accurate anthropometry and mass distribution, can be easily instrumented for testing, more closely simulates the responses of a child during impact testing and has more consistent head and chest acceleration measurements during impact testing.

As with the infant test dummy, the final rule establishes a complete set of design specifications for the 3-year-old test dummy. For the 3-year-old test dummy, NHTSA has provided: a drawing package containing all of the technical details of the dummy parts and the stages of dummy manufacture; a set of master patterns for all molded and cast parts of the dummy; and a maintenance manual containing instructions for the assembly, disassembly, use, adjustment and maintenance of the dummy. These materials will ensure that manufacturers can accurately and consistently produce the test dummy.

The drawings and the maintenance manual for the 3-year-old test dummy are available for examination at the agency's docket section. Copies of these drawings and the maintenance manual can be obtained from the Keuffel and Esser Co., 1512 North Danville Street, Arlington, Va. 22201. In addition, patterns for all the cast and molded parts are available on a loan basis from the agency's Office of Vehicle Safety Standards, at the address given at the beginning of this notice.

Calibration Requirements

Unlike the infant test dummy, the 3-year-old child test dummy can be instrumented with accelerometers to measure the forces imposed on the dummy during an impact. Thus, in Standard No. 213, *Child Restraint Systems,* the 3-year-old test dummy is used to measure the amount of head and knee excursion and the magnitude of head and chest acceleration allowed by the child restraint.

Since a test dummy is a complex instrument required to measure important parameters, it is essential that the test dummy be properly calibrated to ensure accurate and repeatable results. NHTSA has developed detailed test dummy specifications and instrumentation requirements to ensure that the test dummies are as much as possible identically constructed and identically instrumented. The agency also developed calibration performance requirements that the test dummy must meet in dynamic and static tests. The calibration tests will determine whether the test dummies are uniformly constructed and properly instrumented.

In its comments, GM reported that it was unable to calibrate its 3-year-old test dummies. As mentioned previously, NHTSA loaned GM one of the agency's test dummies for the purpose of resolving the reported calibration problem. Using the NHTSA test dummy equipped with NHTSA's accelerometers, GM was able to meet the peak resultant acceleration requirements set for the dummy's head in specified pendulum impact tests, but was not able to meet the lateral acceleration requirement. When the same dummy was tested with GM's accelerometers, the dummy did not meet any of the head acceleration performance requirements. In the case of the chest calibration performance requirements, the accelerations measured by GM test dummies and the NHTSA test dummy, using both GM's and NHTSA's accelerometers, were within the range set for peak resultant and lateral acceleration.

GM also said that because the agency did not define the term "unimodal" it was not certain that the acceleration measurements that it made complied with the requirement that the acceleration-time curves for the head and chest impacts be unimodal. To clarify the requirement, NHTSA has defined unimodal in the final rule to mean an acceleration curve that only has one prominent peak and has specified that the measured acceleration-time curve during the head and chest impact testing need only be unimodal during a short time period when the accelerations are above a specified level.

GM attributed the calibration problem to resonances in the head and chest of the test dummies. (A resonance is a vibrational state that can magnify the accelerations imposed on the test dummy and thus prevent the accurate measurement of those accelerations.) GM said that because of the possible inaccurate measurements caused by the resonances, the test dummy cannot be used as an objective tool for assessing the performance of child restraint systems.

The calibration testing done for the agency indicates that the acceleration responses for the head and chest pendulum impacts include a limited amount of vibration. Such responses exist to some extent in any acceleration measuring device and are also found in similar pendulum impact tests of the Part 572 adult test dummy. However, dynamic sled tests of child test dummies in child restraint systems have demonstrated that the test dummies produce very repeatable results and do not show the vibrations found in the more severe pendulum impact tests. The agency's calibration tests also show that the test dummies produce very repeatable results. Even in GM tests of its three test dummies equipped with GM's instrumentation, the test dummies produced repeatable results. Such repeatability could not be obtained with resonating systems. Based on a review of GM's and the agency's test data, NHTSA concludes that the GM calibration failures are not attributable to resonances, but are very likely due to the differences, discussed below, in the mounting of the accelerometers in the GM test dummies.

NHTSA recognizes that because of different instrumentation and test procedures, different test facilities may obtain different results in what are essentially the same tests. To reduce such differences, NHTSA proposed requirements to standardize the test and instrumentation procedures. In calibration tests conducted at Calspan

Corporation the measurements of the peak resultant head accelerations and the lateral head acceleration were found to be close to the upper limits of the tentative head calibration requirements (112 g peak resultant acceleration and 5 g lateral acceleration) proposed by the agency. To further accommodate expected differences between different testing facilities, NHTSA has decided to broaden the head acceleration calibration requirements for peak resultant head acceleration to 115 g's and for lateral acceleration to 7 g's.

Instrumentation

Based on a review of GM's and the agency's test data, NHTSA concludes that one of the significant differences between NHTSA's and GM's test dummy is the manner in which the accelerometer mounting plate is attached to the head of the test dummy. Finding what it thought was an incompatibility between the angle of the accelerometer mounting plate bolt and the angle of the surface of the plate that attaches to the dummy's head, GM changed the angle of the surface in its test dummies. However, NHTSA specified the difference in the two angles for an important reason. Having a difference in the angles allows for a firmer attachment of the accelerometer mounting plate to the dummy. The difference in the firmness of the attachment of the accelerometer mounting plate may account for the additional acceleration that occurred in the head calibration tests of the GM test dummies.

GM also asked the agency to set a torque specification for the accelerometer mounting plate bolt. In response to GM's request, the agency has added a torque specification of 10 ft. lbs. to the specifications set out in the maintenance manual for the test dummy.

GM said that another possible source of the difference between the measurements it obtained with its own test dummies and the measurements it made with the NHTSA test dummies could be due to differences in the type and location of the accelerometers in the test dummies. GM noted that the specifications proposed in the rule allow the use of different types of accelerometers by allowing a number of different accelerometer placements within the test dummy.

As explained below, testing done for the agency has shown that the use of different types of accelerometers within the permissible locations does not prevent the test dummy from producing accurate and repeatable results. However, to further reduce the possibility of test differences due to accelerometer placement, the agency has more specifically defined several of the permissible accelerometer mounting locations.

Testing done for the agency at two different facilities to develop the calibration requirements used two types of accelerometers and different accelerometer locations. That testing produced no appreciable differences in test results and showed that different facilities could obtain repeatable results, when the accelerometers are properly mounted.

The agency's test experience with the adult test dummy also shows that minor differences in accelerometer mounting locations do not affect the ability of the test dummy to produce similar and repeatable results. The number of permissible accelerometer locations allowed for the adult test dummy is in some cases larger than the number permitted in the child test dummy. Yet no significant differences in test results for the adult test dummy have been encountered due to accelerometer location.

GM's own test data also indicate that use of different types of properly mounted accelerometers and different mounting locations produces only minor variations in the measurements. GM tested NHTSA's test dummy using two types of accelerometers mounted at different locations within the prescribed tolerances. The average measured acceleration in the chest impact tests varied by only 4 percent between the two types of accelerometers. It was only when GM used the improperly installed accelerometer mounting block in the head impact tests, discussed above, that GM obtained a 14 percent difference in measured accelerations within the NHTSA dummy using two types of accelerometers.

Calibration Procedures

GM also raised questions about the procedures for conducting the chest and head calibration tests. GM said that the sequence of procedures for positioning the dummy for the chest pendulum impact test was ambiguous since it called for the test dummy to be adjusted so that the area on the chest of the dummy immediately adjacent to the impact point is vertical. However, that surface of the dummy is curved and has variable radii. GM also pointed out that when the dummy is moved to the more vertical position, the area that a pendulum strikes the dummy also moves so that the portion of the test dummy's chest which is too rigid might be impacted. NHTSA has changed the dummy's

positioning procedures so that a plane tangent to the surface of the chest immediately adjacent to the designated impact area is vertical. The positioning of the pendulum is also changed to ensure that the pendulum consistently strikes the chest at the designated point on the chest.

GM also raised questions about the positioning of the pendulum for the head calibration impact tests. The proposed requirement specified that the impact point for the pendulum was to be measured relative to the top of the dummy's head. GM said that because of differences in the thickness and shape of the dummy's skin, the location of the impact point can vary. GM recommended determining the impact point relative to the head center of gravity reference pins which protrude through the test dummy's skin.

NHTSA has evaluated GM's proposed head impact positioning procedure and decided to adopt a modified version of it. A measurement made from the head center of gravity pins will be used to determine the head impact point to ensure that all test dummies will be struck in the same location during the head impact tests.

GM said that the lumbar spine calibration test was ambiguous because it did not specify either the direction in which the force was to be applied to the lumbar spine or the location on the spine which is to be used to define the direction of force application. GM also pointed out that the procedures erroneously set requirements for femur friction plungers which are not included in the 3-year-old test dummy. NHTSA has corrected the test procedures to specify the direction of force application and deleted the reference to friction plungers.

GM also criticized ambiguities in the specification for the amount of chest deflection. NHTSA has reevaluated the need for a chest deflection specification and has decided to eliminate the requirement, since the chest acceleration test should serve as an adequate calibration test of the dummy's chest.

Repeatability

Ford, GM and the Motor Vehicle Manufacturers Association (MVMA) raised questions about the ability of the 3-year-old test dummy to give repeatable results in crash testing. MVMA proposed that the agency conduct another series of tests to determine the amounts of variances in test results between the same dummy in several tests and between different dummies in the same tests.

MVMA and Ford also recommended that the additional testing also include testing of the proposed Economic Commission for Europe (ECE) test dummy to determine if it would be an objective test device. The agency has not conducted an evaluation of the ECE test dummy since there are no calibration requirements for that test dummy. Without calibration requirements, there is no means to ensure the accuracy of the measurements obtained by the test dummy and therefore it cannot be used as an objective test device.

The agency has already conducted three separate research programs to evaluate the 3-year-old test dummy as an objective test device. As explained below, those programs have shown that the test dummy is an objective device that produces repeatable test results.

During 1977–78, the agency had simultaneous research programs conducted at the University of Michigan's Highway Safety Research Institute and NHTSA's Vehicle Research and Test Center in East Liberty, Ohio to develop and evaluate the calibration performance requirements and test procedures for the 3-year-old test dummy. Four of the 3-year-old test dummies were used in the testing program. Two of the dummies were tested by one laboratory and the other two were tested by the other laboratory. Then the two sets of test dummies were exchanged by the laboratories and subjected to the same calibration tests. By setting up the research program in this manner, the agency was able to determine if the test procedures and calibration performance requirements were repeatable from test dummy to test dummy and from test laboratory to test laboratory. The test results from both research programs showed that the calibration test procedures and performance requirements produced repeatable results.

The repeatability of the test dummy was reaffirmed in further testing conducted between June 1978 and July 1979 at Calspan Corporation. In that research program, four of the 3-year-old test dummies were used with two different types of child restraints—one shield type (Chrysler Mopar) and one plastic shell with integral harness type (GM Love Seat). Each of the four test dummies was subjected to six sled tests at 30 mph in both types of child restraints. The harness type restraint was also subjected to 3 sled tests at 20 mph with the top tether strap unattached.

To determine the repeatability of the test dummies, the head and chest accelerations and the amounts of head and knee excursion experienced

by the test dummies were analyzed. That analysis showed that the amount of deviation measured by the same dummy in the different tests was small and similar in nature to the results obtained with Part 572 test dummies representing adults, which have been established as objective test devices.

In addition to examining the results obtained for the same dummy in different tests, the research program also examined the results for each of the four 3-year-old dummies in the same test. Based on previous testing of test dummies representing adults, it was determined that if the absolute deviation of the oberved test results for each performance criteria, such as head acceleration, was less than six percent from the mean results, then the dummies had sufficient repeatability. In all but one of the test results, the deviation from the mean was less than six percent. The single exception involved the amount of chest acceleration measurered in the test dummies in the 20 mph tests of an untethered harness-type restraint. In that instance the deviation was only 7.7 percent. The reason for the variation in that test is probably due to the increased movement of the seat because the tether strap was unattached, rather than due to any variability in the test dummy.

Costs

The agency has considered the economic and other impacts of this final rule and determined that this rule is not significant within the meaning of Executive Order 12044 and the Department of Transportation's policies and procedures for implementing that order. The agency's assessment of the benefits and economic consequences of this final rule are contained in a regulatory evaluation which has been placed in the docket. Copies of that regulatory evaluation can be obtained by writing to NHTSA's docket section at the address given in the beginning of this notice.

The cost of the infant test dummy is estimated to be approximately $1,000. The 3-year-old test dummy should cost approximately $4,000. The materials used in the dummies are commercially obtainable. The availability of the test dummy drawing and other specifications means that any manufacturer can produce its own test dummy and does not have to purchase the test dummy from an independent test dummy manufacturer.

Strollee, a child restraint manufacturer, and the Juvenile Products Manufacturers Association asked the agency to reconsider the calibration requirements set for the 3-year-old dummy. They argued that the cost of calibrating the test dummy is approximately $800 to $1,100. Combined with the cost of the sled testing, each test of a car seat could cost approximately $2,000-$3,500. Such costs "would certainly discourage a manufacturer from testing frequently," Strollee said.

The calibration requirements set by this final rule are essential to ensure that the test dummy is an objective test device that will produce repeatable results in dynamic sled tests. So that the requirements would be practicable, the agency established the minimum number of calibration tests possible which would still ensure that the test dummy is properly constructed and properly instrumentated. Each manufacturer, in the exercise of due care, must determine how frequently it will calibrate its test dummy and how frequently it will run tests to determine its child restraint's compliance with Standard No. 213.

In its own testing, the agency has used some test dummies in as many as 15 tests over a 2-3 week period without recalibrating them and has not found any difference in their performance. With other test dummies, the agency has found it necessary to recalibrate them after several tests. However, in its compliance testing the agency will use properly calibrated dummies.

The principal authors of this notice are Vladislav Radovich, Office of Vehicle Safety Standards, and Stephen Oesch, Office of Chief Counsel.

In consideration of the foregoing, Part 572, *Anthropomorphic Test Dummies*, of Title 49 of the Code of Federal Regulations is amended as follows:

1. A new subsection (c) is added . . . Subpart A—General, Section 572.4 Terminology (49 CFR 572.4) to read as follows:

(c) The term "unimodal", when used in Subpart C, refers to an acceleration-time curve which has only one prominent peak.

2. A new Subpart C—Three Year Old Child, is added . . . .

Issued on December 20, 1979.

Joan Claybrook
Administrator

44 F.R. 76527
December 27, 1979

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies
(Docket No. 78-9, Notice 5; Docket No. 73-8, Notice 9)

ACTION: Final rule.

SUMMARY: This notice amends Part 572, Anthropomorphic Test Dummies, to allow the use of an alternative chemical foaming agent for molding the dummy's flesh parts. In response to a Ford petition, the notice also makes a minor technical amendment to modify one specification in the calibration procedures for the neck of the test dummy representing a 50th percentile male. The effect of the latter amendment is to simplify the calibration test.

DATES: The amendment is effective on June 16, 1980.

ADDRESSES: Petitions for reconsideration should refer to the docket numbers and be submitted to: Docket Section, Room 5108, National Highway Traffic Safety Adminstration, 400 Seventh Street, S.W., Washington, D.C. 20590. (Docket hours: 8:00 a.m. to 4:00 p.m.)

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2264)

SUPPLEMENTARY INFORMATION: This notice amends Part 572, Anthropomorphic Test Dummies, to modify the design specification for molding the test dummy's flesh parts to allow the use of an alternative chemical foaming agent, "OBSH/TBPP," to the currently specified "Nitrosan." In response to a petition from the Ford Motor Company, the agency is also making a minor technical amendment to simplify the calibration test for the neck used in the 50th percentile male test dummy. The amendment deletes the current specification and substitutes the specification used in the calibration testing of the recently issued three-year-old child test dummy (44 FR 76527, December 27, 1979).

The agency published the proposed changes to the flesh molding and neck calibration specifications in the *Federal Register* of December 18, 1978 (43 FR 58843). Only one party, Ford Motor Co., commented on the proposed changes and Ford supported the adoption of both proposed changes.

Molding Specifications

The agency proposed the changes in the molding specification because the sole manufacturer of "Nitrosan," the currently specified chemical foaming agent, has discontinued its production due to the hazardous propensities of the compound during its manufacturing process. Based on an extensive research program to develop and test new chemical foaming agents (which was fully described in the notice of proposed rulemaking), the agency found that test dummy flesh parts made from "OBSH/TBPP" have comparable material properties to those produced with "Nitrosan" and are superior in some respects. Based on an evaluation of the research results, the agency concludes that flesh parts produced from "OBSH/TBPP" can be used for all purposes for which test dummies are required by the applicable safety standards and the dummy performance will be equivalent to the performance of dummies produced with "Nitrosan." Therefore, the agency is amending the regulation to allow the use of "OBSH/TBPP."

Drawings and specifications outlining the formulations for molding dummy flesh parts with the "OBSH/TBPP" compound are available for examination in NHTSA Docket 73-8 and Docket 78-9, Room 5108, 400 Seventh Street, S.W., Washington, D.C. 20590. Copies of these drawings may also be obtained from the Keuffel and Esser Company, 1513 North Danville Street, Arlington, Virginia 22201.

Neck Calibration Requirements

In response to a request from Ford, the agency

proposed an amendment to the pendulum impact test specification established in section 572.7(b) for the calibration of the 50th percentile male test dummy. The amendment would have replaced the current specification with the specification for calibration testing established for the 3-year old child test dummy.

The pendulum neck test found in Subpart B of the standard for the 50th percentile male dummy is intended to measure the bending properties of the dummy's neck. The current test specifies that, during the neck bending procedure, the pendulum shall not reverse direction until "T = 123 ms." This means that from the time the pendulum contacts the arresting material which it must strike, the pendulum cannot reverse direction for 123 milliseconds. The original intent of this requirement was to negate the effects of arresting material having rebound characteristics that could force the pendulum to reverse its motion before the bending properties of the neck could be measured. Ford requested a change in this specification because in certain instances the use of a special apparatus may be required to hold the pendulum arm for at least 123 milliseconds after the pendulum has impacted the arresting material.

Research by NHTSA and the industry has shown that when appropriate crushable materials are used in pendulum impact tests, the pendulum does not reverse its motion until the neck has straightened out and the head's center of gravity has returned to its original zero-time position relative to the pendulum. At that time, all measurements of the neck bending characteristics are completed and the pendulum's motion thereafter is inconsequential. In light of this research, the recent addition of Subpart C to Part 572, specifying requirements for the 3-year-old child dummy, modified the language concerning reversal of the pendulum arm during the neck impact test. Section 572.17 of that subpart specifies that "the pendulum shall not reverse direction until the head's center of gravity returns to the original zero time position relative to the pendulum arm." Under this requirement, a dummy user could only use an arresting material for the impact test whose rebound characteristics would not overcome the pendulum's inertia before the head and neck returned to the zero time position.

Since the specification in Subpart C of Part 572 represents a simplification of the pendulum impact test specified in the current Subpart B, without any degradation of performance characteristics, the agency is amending section 572.7(b) of Subpart B to read as section 572.17(b) of Subpart C.

Costs

The agency has considered the economic and other impacts of this final rule and determined that this rule is not significant within the meaning of Executive Order 12044 and the Department of Transportation's policies and procedures for implementing that order. Based on that assessment, the agency has concluded also that the economic and other consequences of this proposal are so minimal that a regulatory evaluation is not necessary. The impact is minimal since there is no estimated increase in the cost of the test dummies due to the change in the foaming agent and neck calibration specification. In addition, the amendments would have no adverse environmental effects.

The engineer and lawyer primarily responsible for this notice are Vladislav Radovich and Stephen Oesch, respectively.

In consideration of the foregoing, Part 572, Anthropomorphic Test Dummies, of Title 49 of the Code of Federal Regulations is amended as follows:

1. Technical drawing ATD-6070 incorporated by reference in Section 572.15 of Subpart C—3-Year-Old-Child is amended to add the formulation for "OBSH/TBPP" foaming compound.

2. Technical drawing ATD-7151 incorporated by reference in Section 572.5 of Subpart B—50th Percentile Male is amended to add the formulation for "OBSH/TBPP" foaming compound.

3. The last sentence of Section 572.7(b) of Subpart B—50th Percentile Male is amended to read:

"The pendulum shall not reverse direction until the head's center of gravity returns to the original zero time position relative to the pendulum arm."

Issued on June 9, 1980.

Joan Claybrook
Administrator

45 FR 40595
June 16, 1980

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies Representing 6-month-old and 3-year-old Children (Docket No. 78-09; Notice 6)

ACTION: Response to petition for reconsideration.

SUMMARY: This notice grants in part and denies in part a General Motors (GM) petition for reconsideration of the 3-year-old test dummy requirements set in Part 572, Anthropomorphic Test Dummies. GM said it could not calibrate its test dummies because of resonances in the dummies, which prevent accurate acceleration measurements. NHTSA found that GM's calibration problems are due to its failure to comply with all of the design specifications set for the dummy and its use of single axis rather than triaxial accelerometers. In another notice in today's *Federal Register* the agency is proposing to require the use of triaxial accelerometers. This notice also corrects typographical errors in the final rule.

DATES: The amendments are effective on June 26, 1980.

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590 (202-426-2264)

SUPPLEMENTARY INFORMATION: On December 27, 1979, NHTSA published in the *Federal Register* a final rule amending Part 572, Anthropomorphic Test Dummies, to establish specifications and performance requirements for two test dummies, one representing a 6-month-old child and the other representing a 3-year-old child (44 FR 76527). The dummy is used in testing child restraint systems in accordance with Federal Motor Vehicle Safety Standard No. 213, Child Restraint Systems. General Motors (GM) timely filed a petition for reconsideration concerning the specifications and performance requirements set for the test dummy representing a 3-year-old child. No other petitions were filed and GM raised no issues concerning the specifications set for the test dummy representing a 6-month-old child.

In its petition, GM again argued that the 3-year-old test dummy is not an objective test device for acceleration measurement because of resonances in the test dummy. GM requested the agency not to use the dummy as an acceleration measurement device until the resonances are eliminated.

GM also asked the agency to revise its accelerometer specifications to require the axes of triaxial accelerometers to intersect at a single point. GM said the change would reduce possible variability between different types of accelerometers. In addition, GM requested a further change in the lumbar spine test procedures to permit the use of either a pull or a push force during the spine calibration tests.

GM also raised questions about the possible use of different signal filtering techniques at different test laboratories. GM said that the use of different filters might account for differences between its testing and testing done for the agency.

NHTSA has evaluated GM's comments and the agency's responses to GM's petition are discussed below. All requests that are not specifically granted below are denied.

Signal Filtering

GM argued that one of the possible reasons for the differences between the test dummy head calibration test results at GM and other laboratories was the use of incorrect filters (devices used in the electronic processing of the acceleration measurements) by some laboratories. Part 572 requires the acceleration measurements to be filtered according to the Society of Automotive Engineers Recommended Practice J211a. Both Calspan Corporation and the agency's Vehicle Research and Test Center (VRTC), which did

testing for NHTSA, used the required filter and instrumented their test dummies with triaxial accelerometers. The test results at VRTC were all within the limits set by the agency.

The Calspan test results originally reported to the agency were also within the limits. In rechecking its data, however, Calspan determined that it had made an error in calculating the peak resultant accelerations in the head calibration test. The corrected data showed that in one of the four head calibration tests the peak resultant acceleration was 116 g's, which exceeds the 115 g limit set in Part 572. To evaluate possible variability in the processing of the data by different laboratories, the agency also had HSRI and VRTC process the Calspan data. For the tests which exceeded the calibration limit, there was little variability between the different laboratories, with HSRI measuring 118 g's and VRTC measuring 117.4 g's.

The dummies Calspan used in the calibration testing were subsequently used in sled tests of child restraint systems. In the sled tests, the dummies provided consistent and repeatable acceleration measurements. Since dummies that experience 118 g's in the head calibration test can provide consistent and repeatable acceleration measurements, the agency, in a separate notice appearing in today's *Federal Register*, is proposing to increase the head resultant acceleration calibration limit from 115 to 118 g's.

NHTSA has found that the University of Michigan's Highway Safety Research Institute (HSRI), which instrumented its dummies with single axis accelerometers, did not use the filter required by Part 572, but instead used a filter that deviates from the required filter. To determine whether the use of the HSRI filter made a difference in the calibration tests conducted by that laboratory, the agency had HSRI process the accelerations recorded during its head calibration tests with the correct filter. Using the correct filter, HSRI found that in five of the eighteen head calibration tests the peak resultant acceleration exceeded the limits set in Part 572. In those five tests, the peak resultant acceleration ranged from 115.9 to 119.1 g's.

The peak resultant accelerations and the shape of the acceleration pulses in the HSRI tests that exceeded the calibration limit were smaller than and not the same shape as the measurements made by GM in its tests, which also used test dummies instrumented with single axis accelerometers. In the two sets of data submitted by GM to the docket, the peak resultant accellerations ranged from 119 to 130 g's. In addition, the shape of the GM head acceleration pulse was different than the pulses measured in all the testing done for the agency. In the GM acceleration pulse, there is a brief secondary peak after initial peak is reached. Based on the agency's testing of adult test dummies, such secondary peaks are usually indications of accelerometer vibration resulting from improper installation.

The differences between the GM testing and the testing done for the agency is not attributable to the use of different filters. When all the test data is filtered as specified in the standard, the peak resultant accelerations measured by GM are still greater than those obtained at the other three laboratories. As explained below, use of triaxial accelerometers, rather than the single axis accelerometers used by GM and HSRI, will provide repeatable, complying results in the head calibration test.

Instrumentation

Part 572 allows the use of two different types of accelerometers (single axis and triaxial) in the test dummy and sets different axis intersection requirements for each type of accelerometer. GM asked the agency to apply the axis intersection requirements set for single axis accelerometers to triaxial accelerometers. It said such a requirement would reduce the variability in test measurements resulting from use of different types of accelerometers.

The agency's testing has demonstrated that variability can be sufficiently controlled by use of the existing specification with a triaxial accelerometer. Testing done by GM has also shown that the test dummy can be properly calibrated with triaxial accelerometers. When GM tested one of the agency's test dummies with GM's accelerometer mounting place and single axis accelerometers, the peak lateral accelerations measured in the test dummy's head exceeded the limits currently set in the regulation. Yet when GM tested the same test dummy equipped with triaxial accelerometers placed on the mounting plate required by the design specifications, the test dummy easily met the calibration requirements. Therefore, rather than adopt GM's proposal, the

agency is proposing, elsewhere in today's *Federal Register*, to require the use of only triaxial accelerometers.

Resonances

GM said that "the consistent lack of correlation between dummy tests at General Motors and at other laboratories" was attributable to resonances in the test dummy. It said the dummy could not be used as an objective test device until the resonances were eliminated. As explained previously, the variability between different test laboratories can be controlled by the use of triaxial accelerometers.

One reason for the "resonances" in the GM test results may be GM's failure to use dummies that fully comply with the agency's design specifications. The agency's review of some of the blueprints used in the construction of the GM test dummies revealed that GM did not use the accelerometer mounting plate required by the NHTSA design specifications. The mounting plate used by GM was smaller and presumably lighter than the plate specified by the agency. Use of a smaller and lighter plate may have also contributed to the higher acceleration readings obtained by GM.

Thus, the agency denies GM's request not to use the dummy for acceleration measurement and concludes that the 3-year-old test dummy instrumented with triaxial accelerometers is an objective test device for measuring accelerations in child restraints.

Spine Calibration

The calibration requirements for the lumbar spine of the test dummy specify the amount of flexion the spine must experience when force is applied to it. The calibration procedures specify that the applied force is to be applied as a pull force. GM requested the agency to permit the use of a "push" force saying that it "is more convenient to apply in some test set-ups."

When the agency developed the spine calibration tests, both pull and push forces were used to apply force to the spine. However, the testing done by the Highway Safety Research Institute (HSRI) found that use of a push force "proved to be awkward and inconsistent." HSRI also found that use of a pull force was simpler procedure and provided consistent data. Based on the HSRI testing, the agency has decided to deny GM's request since the use of a pull force provides a simple, repeatable method to measure compliance.

Corrections

In the final rule issued on December 12, 1979, NHTSA amended the instrumentation requirements for the chest to more specifically define several of the accelerometers mounting locations. The revised specifications inadvertently reversed two of the axis mounting locations in the chest. The specifications have been amended in this notice to correct that error.

The test procedure for conducting the head impact test set forth in the final rule contained a typographical error. The tolerance for positioning the test probe was listed as ± 1.1 inches. The regulation has been amended in this notice to specify the correct tolerance of ± 0.1 inches.

The performance requirement for the neck calibration test was incorrectly listed as 84 degrees ± 18 degrees rather than the correct figure of 84 degrees ± 8 degrees. The necessary corrections have been made in this notice to the regulation.

The principal authors of this notice are Vladislav Radovich, Office of Vehicle Safety Standards, and Stephen Oesch, Office of Chief Counsel.

In consideration of the foregoing, Subpart C—3-Year-Old Child of Part 572, Anthropomorphic Test Dummies, of Title 49 of the Code of Federal Regulations, is amended as follows:

1. Section §572.1(c)(2) is amended to read as follows:

(2) Adjust the test probe so that its longitudinal centerline is at the forehead at the point of orthogonal intersection of the head midsagittal plane and the transverse plane which is perpendicular to the "Z" axis of the head (longitudinal centerline of the skull anchor) and is located 0.6 ± 0.1 inches above the centers of the head center of gravity reference pins and coincides within 2 degrees with the line made by the intersection of horizontal and midsagittal planes passing through this point.

2. The first sentence of section §572.17(b) is amended to read as follows:

(b) When the head-neck assembly is tested in accordance with paragraph (c) of this section, the head shall rotate in reference to the pendulum's longitudinal centerline a total of 84 degrees ± 8 degrees about its center of gravity, rotating to the

extent specified in the following table at each indicated point in time, measured from impact, with the chordal displacement measured at its center of gravity.

3. Section §572.21(c) is amended to read as follows:

(c) Accelerometers are mounted in the thorax on the mounting plate attached to the vertical transverse bulkhead shown in the drawing subreferenced under assembly No. SA 103C 030 in drawing SA 103C 001 so that their sensitive axes are orthogonal and their seismic masses are positioned relative to the axial intersection point located in the midsagittal plane 3 inches above the top surface of the lumbar spine and 0.3 inches dorsal to the accelerometer mounting plate surface. Except in the case of triaxial accelerometers, the sensitive axes shall intersect at the axial intersection point. One accelerometer is aligned with its sensitive axis parallel to the vertical bulkhead and midsagittal planes, and with its seismic mass center at any distance up to 0.2 inches to the left, 0.1 inches inferior and 0.2 inches ventral of the axial intersection point. Another accelerometer is aligned with its sensitive axis in the transverse horizontal plane and perpendicular to the midsagittal plane and with its seismic mass center at any distance up to 0.2 inches to the right, 0.1 inches inferior and 0.2 inches ventral to the axial intersection point. A third accelerometer is aligned with its sensitive axis parallel to the midsagittal and transverse horizontal planes and with its seismic mass center at any distance up to 0.2 inches superior, 0.5 inches to the right and 0.1 inches ventral to the axial intersection point. In the case of a triaxial accelerometer, its axes are aligned in the same way that the axes of three separate accelerometers are aligned.

Issued on June 17, 1980.

Joan Claybrook
Administrator

45 FR 43352
June 17, 1980

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies
(Docket No. 78-09; Notice 8)

ACTION: Response to petitions for reconsideration, final rule and correction.

SUMMARY: This notice amends Subpart C of Part 572, Anthropomorphic Test Dummies, to specify the use of a triaxial accelerometer in the test dummy representing a 3-year-old child. The use of a triaxial accelerometer will eliminate calibration problems associated with single axis accelerometers. The notice also denies petitions filed by Ford Motor Company and General Motors Corporation seeking reconsideration of the agency's June 26, 1980 notice responding to a prior General Motors Corporation petition for reconsideration. Finally, the notice corrects a typographical error in the agency's June 26, 1980 final rule.

DATES: The amendments are effective on December 15, 1980.

ADDRESSES: Petitions for reconsideration should refer to the docket number and be submitted to: Docket Section, Room 5108, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

FOR FURTHER INFORMATION CONTACT:

Mr. Vladislav Radovich, Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590
(202-426-2264)

SUPPLEMENTARY INFORMATION: This notice amends Subpart C of Part 572, Anthropomorphic Test Dummies, to change several of the requirements for the test dummy representing a 3-year-old child. The test dummy is used in testing child restraint systems in accordance with Federal Motor Vehicle Safety Standard No. 213, Child Restraint Systems.

The notice amends Subpart C of Part 572 to specify the use of triaxial accelerometers, instead of single axis accelerometers, in the head and chest of the test dummy. In addition the notice increases the upper limit for permissible resultant acceleration in the head calibration test from 115 g's to 118 g's. The agency published a notice proposing these changes in the *Federal Register* for June 26, 1980 (45 FR 43355). Only two parties, Ford Motor Company (Ford) and General Motors Corporation (GM), submitted comments on the proposal. The final rule is based on the data submitted in those comments, data obtained in the agency's testing and data obtained from other pertinent documents. Significant comments submitted to the docket are addressed below.

This notice also denies petitions filed by Ford and GM seeking reconsideration of the agency's June 26, 1980 notice (45 FR 43352) that granted in part and denied in part a prior GM petition for reconsideration.

Finally, this notice corrects a typographical error in an amendment made in the agency's June 26, 1980 notice (45 FR 43352) responding to a prior GM petition for reconsideration.

Resonances

Ford and GM both agree with the agency that the test dummy representing a 3-year-old child is an objective test device for measuring the amount of head and knee excursion that occurs in child restraint system testing using the test dummy. The fundamental disagreement stated in the Ford and GM comments and petitions for reconsideration is whether the test dummy is an objective test device for measuring accelerations in the dummy's head and chest during child restraint testing. GM argues that the test dummy is not an objective

device because of the presence of resonances in the head and chest of the test dummy. Ford says that the test dummy "may be a suitable measuring device, when there is no head impact (such as in a shoulder harness type of child restraint)" during child restraint testing. It, however, argues that if there is a head impact in the child restraint testing, then the test dummy's head will resonate.

Ford and GM both argue that the resonances can reinforce or attenuate the measurement of impact forces on the test dummy. Thus, if the test dummy does resonate, the acceleration measured in the test dummy may not represent the actual forces experienced by the test dummy.

Ford argues that the source of the resonance is an oscillation of the urethane skull of the test dummy. Ford included with its petition and comments on the June 26, 1980 proposal the results of several tests in which it struck the head of the test dummy with a rubber mallet. Ford said that regardless of the direction of the impact, the head resonated with a frequency of approximately 200 Hertz (Hz) when it was struck.

The agency has reviewed the Ford and other test data and concluded that the test dummy is an objective test device that can be used for measuring accelerations. As explained below, the agency's conclusion is based on an analysis of the structure of the test dummy's head and chest and the relationship between that structure and the impact response of the test dummy.

Many physical structures, such as the test dummy's head, have a natural or resonating frequency at which they will vibrate when they are driven by a force of the same frequency. When resonance occurs, small variations in the applied force can produce large variations in the measured acceleration, thus preventing accurate measurement of the acceleration. The resonance, however, will not occur if the driving force is of a frequency that is below the natural or resonating frequency of the object being struck.

Analysis of the test dummy shows that the natural or resonating frequency of the head is approximately 128 Hz, while the natural frequency of the accelerometer attachment in the test dummy's head is approximately 255 Hz. The natural resonating frequencies of the test dummy's chest and chest accelerometer attachment are approximately 85 Hz and 185 Hz.

Impacts with hard and unyielding objects, such as the unpadded portion of a car's instrument panel, can create high frequencies, generally up to 1,000 Hz. Impacts with soft and yielding surfaces, such as a padded child restraint, create low frequencies, generally less than 50 Hz.

The test used in Standard No. 213 to evaluate child restraints does not include impacts with hard and unyielding surfaces. In Standard No. 213 testing, the child restraint is placed on a vehicle seat and attached by a lap belt. There is no portion of a vehicle's interior, such as an instrument panel, placed in front of or to the side of the vehicle seat. Thus, during the testing, the dummy will contact the belts or padded surfaces of the child restraint. Since the belts and padded surfaces are yielding and energy-absorbing, contact with them will involve impacts where the frequencies are well below the natural or resonating frequency of the test dummy's head and chest.

Ford raised the issue of whether contact between the head and arms of the dummy during the testing might produce frequencies that will cause the test dummy's head to resonate. Ford said that it had experienced dummy head and arm contact in some of its tests and resonance occurred.

The agency has conducted more than 150 tests of child restraint systems. There have only been 2 tests in which the head of the test dummy struck the toes and resonances occurred. The head-limb contact occurred in those tests because of massive structural failures in the child restraint system.

Although resonances did occur when the head struck the toes, the validity of the acceleration measurement in those tests is irrelevant for determining if the child restraint complied with Standard No. 213, Child Restraint Systems. The structural failure is, by itself, a violation of the standard. The agency had not found head and limb contact affecting acceleration measurements in any child restraint that maintained its structural integrity during the testing.

In the past several years, the agency has conducted 10 tests of the Ford TOT GUARD. In one of those tests, the arm briefly touched the head, but there was no effect on the acceleration measurement. The dummy in those tests was positioned in accordance with the test procedure set out in Standard No. 213. Since the test procedure permits the limbs to be positioned so that they will not inhibit the movement of the head or torso the agency looked at the effect of positioning the dum-

my's arm in different locations on the shield or the side of the TOT GUARD. None of the different arm positions resulted in head to arm contact affecting acceleration measurement.

Triaxial Accelerometers

Part 572 currently allows the use of either triaxial accelerometers or single axis accelerometers to measure accelerations in the head and chest of the 3-year-old child test dummy. The June 26, 1980 notice (45 FR 43355) proposed specifying the use of only triaxial accelerometers in the test dummy to eliminate calibration problems caused by single axis accelerometers. The agency proposed only using triaxial accelerometers after GM was unable to calibrate its test dummies with single axis accelerometers. In GM's head calibration tests, the peak resultant acceleration exceeded the upper limit set by the regulation.

GM agreed that use of a triaxial accelerometer "may reduce the possibility of exceeding the peak acceleration in the dummy calibration test." It, however, argued that the use of triaxial accelerometers will not solve the problem of resonance. As previously explained, the types of impacts experienced in child restraint testing will not produce resonances. The purpose of requiring the use of triaxial accelerometers is to enable manufacturers to calibrate consistently their test dummies within the acceleration limits set in the regulation.

Ford argued that single axis accelerometers are easier to work with, more reliable and more easily repaired than triaxial accelerometers. The agency is not aware of any data, and Ford supplied none, indicating that triaxial accelerometers are less reliable than single axis accelerometers. Contrary to Ford's assertion, a triaxial accelerometer should be easier to use. The axes and seismic mass center of the triaxial acceleromter (Endevco model 7267C-750) currently used in dummy testing are permanently fixed in a mounting block. With single axis accelerometers, three separate accelerometers must be positioned by each user on a mounting block in order to instrument the dummy. Thus the possibility of variation in mounting location between different users is increased by the use of single axis accelerometers.

Single axis accelerometers are more readily repairable than triaxial accelerometers. The agency, however, has used triaxial accelerometers in numerous dummy tests for several years and has found that their repair experience is comparable to single axis accelerometers.

Based on all these considerations, the agency has decided to adopt the triaxial accelerometer requirement as proposed.

Calibration Limit

To accommodate minor variation in test measurements between different test laboratories, the agency's June 26, 1980 notice (45 Fr 43355) proposed to slightly increase the permissible resultant acceleration limit for the head calibration test from 115 g's to 118 g's. Neither Ford nor GM opposed this change, so the agency is adopting it as proposed. Although the agency is expanding the upper limit of the calibration range, experience with the Part 572 adult test dummy has shown that manufacturers will develop production techniques to produce test dummies that have acceleration responses that fall within the middle of the specified calibration range.

Correction

The final rule established by the agency's June 26, 1980 notice (45 FR 43352) amended the head calibration head test procedures. The notice inadvertently made the amendment to section 572.1(c)(2) of Part 572 instead of to section 572.16(c)(2). This notice corrects that typographical error and makes the amendment to section 572.16(c)(2).

Costs

The agency has considered the economic and other impacts of this final rule and determined that this rule is not significant within the meaning of Executive Order 12221 and the Department of Transportation's policies and procedures implementing that order. Based on that assessment, the agency has concluded that the economic and other consequences of this rule are so minimal that a regulatory evaluation is not necessary. The impact is minimal since the primary effect of this rule is to bind the agency to using one of the two types of accelerometers formerly permitted by the regulation. The economic impact on manufacturers choosing to purchase triaxial accelerometers needed to instrument the dummy is approximately $2,500.

The agency finds, for good cause shown, that it is in the public interest that the amendments made

by this notice have an immediate effective date. The immediate effective date is needed since the test dummy will be used in conducting compliance tests for Standard No. 213, Child Restraint Systems, which goes into effect on January 1, 1981.

The engineer and lawyer primarily responsible for this notice are Vladislav Radovich and Stephen Oesch, respectively.

In consideration of the foregoing, Subpart C of Part 572, Anthropomorphic Test Dummies, of Title 49 of the Code of Federal Regulations is revised to read as follows:

1. The first sentence of section 572.16(b) is revised to read as follows:

(b) When the head is impacted in accordance with paragraph (c) of this section by a test probe conforming to §572.21(a) at 7 fps., the peak resultant acceleration measured at the location of the accelerometer mounted in the headform in accordance with §572.21(b) shall be not less than 95g and not more than 118g.

2. Section 572.21(b) is revised to read as follows:

(b) A triaxial accelerometer is mounted in the head on the mounting block (A/310) located on the horizontal transverse bulkhead as shown in the drawings subreferenced under assembly SA 103C 010 so that its seismic mass centers are positioned as specified in this paragraph relative to the head accelerometer reference point located at the intersection of a line connecting the longitudinal centerlines of the transfer pins in the sides of the dummy head with the midsagittal plane of the dummy head. The triaxial accelerometer is aligned with one sensitive axis parallel to the vertical bulkhead and midsagittal plane and its seismic mass center is located 0.2 inches dorsal to and 0.1 inches inferior to the head accelerometer reference point. Another sensitive axis of the triaxial accelerometer is aligned with the horizontal plane and is perpendicular to the midsagittal plane and its seismic mass center is located 0.1 inch inferior to, 0.4 inches to the right of and 0.9 inch dorsal to the head accelerometer reference point. The third sensitive axis of the triaxial accelerometer is aligned so that it is parallel to the midsagittal and horizontal planes and its seismic mass center is located 0.1 inches inferior to, 0.6 inches dorsal to and 0.4 inches to the right of the head accelerometer reference point. All seismic mass centers shall be positioned within ± 0.05 inches of the specified locations.

3. Section 572.21(c) is revised to read as follows:

(c) A triaxial accelerometer is mounted in the thorax on the mounting plate attached to the vertical transverse bulkhead shown in the drawing subreferenced under assembly No. SA 103C 030 in drawing SA 103C 001 so that its seismic mass centers are positioned as specified in this paragraph relative to the thorax accelerometer reference point located in the midsagittal plane 3 inches above the top surface of the lumbar spine and 0.3 inches dorsal to the accelerometer mounting plate surface. The triaxial accelerometer is aligned so that one sensitive axis is parallel to the vertical bulkhead and midsagittal planes and its seismic mass center is located 0.2 inches to the left of, 0.1 inches inferior to and 0.2 inches ventral to the thorax accelerometer reference point. Another sensitive axis of the triaxial accelerometer is aligned so that it is in the horizontal transverse plane and perpendicular to the midsagittal plane and its seismic mass center is located 0.2 inches to the right of, 0.1 inches inferior to and 0.2 inches ventral to the thorax accelerometer reference point. The third sensitive axis of the triaxial accelerometer is aligned so that it is parallel to the midsagittal and horizontal planes and its seismic mass center is located 0.2 inches superior to, 0.5 inches to the right of and 0.1 inches ventral to the thorax accelerometer reference point. All seismic mass centers shall be positioned within ± 0.05 inches of the specified locations.

4. The document amending Subpart C—Three-Year-Old Child of Part 572, Anthropomorphic Test Dummies, of Title 49 of the Code of Federal Regulations published in the *Federal Register* of June 26, 1980 as 45 FR 43352 is corrected by changing the reference to "Section 571.1(c)(2)" made in the first amendment to the regulation set out on page 43353 to read "572.16(c)(2)."

Issued on December 8, 1980.

Joan Claybrook
Administrator

45 FR 82265
December 15, 1980

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies
[Docket No. 85-05; Notice 1]

ACTION: Final rule.

SUMMARY: This document amends regulations concerning the National Highway Traffic Safety Administration's specifications for anthropomorphic test dummies by revising sections that state where copies of drawings may be obtained.

EFFECTIVE DATE: June 19, 1985.

SUPPLEMENTARY INFORMATION: The purpose of this notice is to amend Part 572 of Chapter V of Title 49, Code of Federal Regulations by revising §§ 572.5(a), 572.15(a)(1), and 572.25(a), which state where copies of drawings and a construction manual describing the materials and the procedures involved in the manufacturing of anthropomorphic dummies may be obtained. The amendment changes the supply source for the drawings and manual from Keuffel and Esser Company to Rowley-Scher Reprographics, Incorporated. This revision is required because of the sale of the Keuffel and Esser Company reproduction facilities to Rowley-Scher Reprographics, Incorporated.

The amendment to Part 572 as set forth below is technical in nature and does not alter existing obligations. This notice simply provides the correct address for obtaining copies of drawings and the construction manuals. The National Highway Traffic Safety Administration therefore finds for good cause that this amendment may be made effective without notice and opportunity for comment, may be made effective within 30 days after publication in the *Federal Register,* and is not subject to the requirements of Executive Order 12291.

In consideration of the foregoing, 49 CFR Part 572 is amended as follows:

1. In § 572.5, paragraph (a) is revised to read as follows: § 572.5 General description.

(a) The dummy consists of the component assemblies specified in Figure 1, which are described in their entirety by means of approximately 250 drawings and specifications that are grouped by component assemblies under the following nine headings:

SA 150 M070—Right arm assembly
SA 150 M071—Left arm assembly
SA 150 M050—Lumbar spine assembly
SA 150 M060—Pelvis and abdomen assembly
SA 150 M080—Right leg assembly
SA 150 M081—Left leg assembly
SA 150 M010—Head assembly
SA 150 M020—Neck assembly
SA 150 M030—Shoulder-thorax assembly

The drawings and specifications are incorporated in this Part by reference to the nine headings, and are available for examination in Docket 73-8, Room 5109, 400 Seventh Street, S.W., Washington, D.C., 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C., 20005, attention Mr. Allan Goldberg and Mr. Mark Krysinski ((202) 628-6667). The drawings and specifications are subject to changes, but any change will be accomplished by appropriate administrative procedures, will be announced by publication in the *Federal Register,* and will be available for examination and copying as indicated in this paragraph. The drawings and specifications are also on file in the reference library of the *Federal Register,* National Archives and Records Services, General Services Administration, Washington, D.C.

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2. In § 572.15, paragraph (a) is revised to read as follows: § 572.15 General description.

(a) (1) The dummy consists of the component assemblies specified in drawing SA 103C 001, which are described in their entirety by means of approximately 122 drawings and specifications that are grouped by component assemblies under the following thirteen headings:

SA 103C 010 Head Assembly
SA 103C 020 Neck Assembly
SA 103C 030 Torso Assembly
SA 103C 041 Upper Arm Assembly Left
SA 103C 042 Upper Arm Assembly Right
SA 103C 051 Forearm Hand Assembly Left
SA 103C 052 Forearm Hand Assembly Right
SA 103C 061 Upper Leg Assembly Left
SA 103C 062 Upper Leg Assembly Right
SA 103C 071 Lower Leg Assembly Left
SA 103C 072 Lower Leg Assembly Right
SA 103C 081 Foot Assembly Left
SA 103C 082 Foot Assembly Right

The drawings and specifications are incorporated in this Part by reference to the thirteen headings and are available for examination in Docket 78-09, Rm 5109, 400 Seventh Street, S.W., Washington, D.C., 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C., 20005, attention Mr. Allan Goldberg and Mr. Mark Krysinski ((202) 628-6667).
* * * * *

(3) An Operation and Maintenance Manual (dated May 28, 1976, Contract No. DOT-HS-6-01294) with instructions for the use and maintenance of the test dummies is incorporated in this Part by reference. Copies of the manual can be obtained from Rowley-Scher Reprographics, Inc. All provisions of this manual are valid unless modified by this regulation. This document is available for examination in Docket 78-09.
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3. In § 572.25, paragraph (a) revised to read as follows: § 572.25 General description.

(a) The infant dummy is specified in its entirety by means of 5 drawings (No. SA 100I 001) and a construction manual which describe in detail the materials and the procedures involved in the manufacturing of this dummy. The drawings and the manual are incorporated in this Part by reference and are available for examination in Docket 78-09, Room 5109, 400 Seventh Street, S.W., Washington, D.C., 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C., 20005, attention Mr. Allan Goldberg and Mr. Mark Krysinski ((202) 628-6667). The drawings and the manual are subject to changes, but any change will be accomplished by appropriate administrative procedures, will be announced by publication in the *Federal Register,* and will be available for examination and copying as indicated in this paragraph. The drawings and manual are also on file in the reference library of the *Federal Register,* National Archives and Records Services, General Services Administration, Washington, D.C.

Issued on April 17, 1985

Diane K. Steed
Administrator

50 F.R. 25422
June 19, 1985

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies

(Docket No. 74-14; Notice 45)

ACTION: Final Rule.

SUMMARY: This notice adopts the Hybrid III test dummy as an alternative to the Part 572 test dummy in testing done in accordance with Standard No. 208, Occupant Crash Protection. The notice sets forth the specifications, instrumentation, calibration test procedures, and calibration performance criteria for the Hybrid III test dummy. The notice also amends Standard No. 208 so that effective October 23, 1986, manufacturers have the option of using either the existing Part 572 test dummy or the Hybrid III test dummy until August 31, 1991. As of September 1, 1991, the Hybrid III will replace the Part 572 test dummy and be used as the exclusive means of determining a vehicle's conformance with the performance requirements of Standard No. 208.

The notice also establishes a new performance criterion for the chest of the Hybrid III test dummy which will limit chest deflection. The new chest deflection limit applies only to the Hybrid III since only that test dummy has the capability to measure chest deflection.

These amendments enhance vehicle safety by permitting the use of a more advanced test dummy which is more human-like in response than the current test dummy. In addition, the Hybrid III test dummy is capable of making many additional sophisticated measurements of the potential for human injury in a frontal crash.

DATES: The notice adds a new Subpart E to Part 572 effective on October 23, 1986.

This notice also amends Standard No. 208 so that effective October 23, 1986, manufacturers have the option of using either the existing Part 572 test dummy or the Hybrid III test dummy until August 31, 1991. As of September 1, 1991, the Hybrid III will replace the Part 572 test dummy and be used as the exclusive means of determining a vehicle's conformance with the performance requirements of Standard No. 208. The incorporation by reference of certain publications listed in the regulation is approved by the Director of the Federal Register as of October 23, 1986.

SUPPLEMENTARY INFORMATION: In December 1983, General Motors (GM) petitioned the agency to amend Part 572, *Anthropomorphic Test Dummies*, to adopt specifications for the Hybrid III test dummy. GM also petitioned for an amendment of Standard No. 208, *Occupant Crash Protection*, to allow the use of the Hybrid III as an alternative test device for compliance testing. The agency granted GM's petition on July 20, 1984. The agency subsequently received a petition from the Center for Auto Safety to propose making Standard No. 208's existing injury criteria more stringent for the Hybrid III and to establish new injury criteria so as to take advantage of the Hybrid III's superior measurement capability. The agency granted the Center's petition on September 17, 1984. On April 12, 1985 (50 FR 14602), NHTSA proposed amendments to Part 572 and Standard No. 208 that were responsive to the petitioners and which, in the agency's judgment, would enhance motor vehicle safety. Twenty-eight individuals and companies submitted comments on the proposed requirements. This notice presents the agency's analysis of the issues raised by the commenters. The agency has decided to adopt the use of the Hybrid III test dummy and some of the proposed injury criteria. The agency has also decided to issue another notice on the remaining injury criteria to gain additional information about the potential effects of adopting those criteria.

This notice first discusses the technical specifications for the Hybrid III, its calibration requirements, its equivalence with the existing Part 572 test dummy, and the applicable injury criteria. Finally, it discusses the test procedure used to position the dummy for Standard No. 208 compliance testing and the economic and other effects of this rule.

Test Dummy Drawings and Specifications

Test dummies are used as human surrogates for evaluation of the severity of injuries in vehicle crashes. To serve as an adequate surrogate, a test dummy must be capable of simulating human impact responses. To serve as an objective test device, the test dummy must be adequately defined through technical drawings and performance specifications to ensure uniformity in construction, impact response, and measurement of injury in identical crash conditions.

Virtually all of the commenters, with the exception of GM, said that they have not had sufficient experience with the Hybrid III to offer comments on the validity of the technical specifications for the test dummy. Since the issuance of the notice, GM has provided additional technical drawings and a Society of Automotive Engineers-developed user's manual to further define the Hybrid III. These new drawings do not alter the basic nature of the test dummy, but instead provide additional information which will enable users to make sure that they have a correctly designed and correctly assembled test dummy. The user's manual provides information on the inspection, assembly, disassembly, and use of the test dummy. Having the user's manual available will assist builders and users of the Hybrid III in producing and using the test dummy. GM also provided information to correct the misnumbering of several technical drawings referenced in the notice.

In addition, the agency has reviewed the proposed drawings and specifications. While NHTSA believes the proposed drawings are adequate for producing the test dummy, the agency has identified and obtained additional information which should make production and use of the test dummy even more accurate. For example, the agency has obtained information on the range of motions for each moving body part of the test dummy. Finally, to promote the ease of assembly, NHTSA has made arrangements with GM to ensure that the molds and patterns for the test dummy are available to all interested parties. Access to the molds will assist other potential builders and users of the Hybrid III since it is difficult to specify all of the details of the various body contours solely by technical drawings.

The agency has adopted the new drawings and user manual in this rule and has made the necessary corrections to the old drawings. The agency believes that the available drawings and technical specifications are more than sufficient for producing, assembling, and using the Hybrid III test dummy.

Commercial Availability of the Hybrid III

A number of commenters raised questions about the commercial availability of the Hybrid III test dummy, noting problems they have experienced in obtaining calibrated test dummies and the instrumentation for the neck and lower leg of the Hybrid III. For example, Chrysler said that it had acquired two Hybrid III test dummies, but has been unable to obtain the lower leg and neck instrumentation for five months. Likewise, Ford said that it has been unable to obtain the knee displacement and chest deflection measurement devices for the Hybrid III. It also said that of the test dummies it had received, none had sufficient spine stiffness to meet the Hybrid III specifications. Ford claimed to have problems in retaining a stable dummy posture which would make it difficult to carry out some of the specified calibration tests. Subsequent investigation showed that the instability was caused by out-of-specification rubber hardness of the lumbar spine, and was eliminated when spines of correct hardness were used. In addition, Ford said that the necks and ribs of the test dummy would not pass the proposed calibration procedures. Finally, Ford said that the equipment needed for calibrating the dummy is not commercially available.

Although the commenters indicated they had experienced difficulty in obtaining the instrumentation for the Hybrid III's neck and lower legs, they did not indicate that there is any problem in obtaining the instrumentation needed to measure the three injury criteria presently required by Standard No. 208, the head injury criterion, chest acceleration, and femur loading and which are being adopted by this rule for the Hybrid III. For example, Volkswagen said it had obtained Hybrid III test dummies with sufficient instrumentation to measure the same injury criteria as with the Part 572. VW did say it had ordered the additional test devices and instrumentation for the Hybrid III but was told the instrumentation would not be available for six months.

The agency notes that there are now two commercial suppliers of the Hybrid III test dummy, Alderson Research Labs (ARL) and Humanoid Systems. Humanoid has built nearly 100 test dummies and ALR has produced five prototype test dummies as of the end of December 1985. Both manufacturers have indicated that they are now capable of producing sufficient Hybrid IIIs to meet the demand for those dummies. For example, Humanoid Systems said that while the rate of production is dependent on the number of orders, generally three test dummies per week are produced. Thus, in the case of the basic test dummy, there appears to be sufficient commercial capacity to provide sufficient test dummies for all vehicle manufacturers.

As to test dummy instrumentation, the agency is aware that there have been delays in obtaining the new neck, thorax, and lower leg instrumentation for the Hybrid III. However, as Humanoid commented, while there have been delays, the supplies of the needed parts are expected to increase. Even if the supply of the lower leg instrumentation is slow to develop, this will not pose a problem, since the agency is not adopting, at this time, the proposed lower leg injury criteria. In the case of the neck instrumentation, the supply problem should be minimized because each test facility will only need one neck transducer to calibrate all of its test dummies. The neck instrumentation will not be needed for a manufacturer's crash testing since at this time, the agency is not adopting any neck injury criteria. In the case of the instrumentation for measuring thoracic deflection, the supplier has indicated that it can deliver the necessary devices within 3 months of the time an order is placed. As to Ford's comment about calibration test equipment, the agency notes that current equipment used for calibrating the existing Part 572 test dummy can be used, with minor modification, to calibrate the Hybrid III test dummy.

Calibration Requirements

In addition to having complete technical drawings and specifications, a test dummy must have adequate calibration test procedures. The calibration tests involve a series of static and dynamic tests of the test dummy components to determine whether the responses of the test dummy fall within specified performance requirements for each test. The testing involves instrumenting the head, thorax and femurs to measure the test dummy's responses. In addition, there are tests of the neck, whose structural properties may have considerable influence on the kinematics and impact responses of the instrumented head. Those procedures help ensure that the test dummy has been properly assembled and that, as assembled, it will provide repeatable and reproducible results in crash testing. (Repeatability refers to the ability of the same test dummy to produce the same results when subjected to several identical tests. Reproducibility refers to the ability of one test dummy to provide the same results as another test dummy built to the same specifications.)

Lumbar Spine Calibration Test

The technical specifications for the Hybrid III set out performance requirements for the hardness of the rubber used in the lumbar spine to ensure that the spine will have appropriate rigidity. NHTSA's test data show that there is a direct relationship between rubber hardness and stiffness of the spine and that the technical specification on hardness is sufficient to ensure appropriate spine stiffness. Accordingly, the agency believes that a separate calibration test for the lumbar spine is not necessary. Humanoid supported the validity of relying on the spine hardness specification to assure adequate stability of the dummy's posture, even though it found little effect on the dummy's impact response. Humanoid's support for this approach was based on tests of Hybrid III dummies which were equipped with a variety of lumbar spines having different rubber hardnesses.

Subsequent to issuance of the notice, the agency has continued its testing of the Hybrid III test dummy. Through that testing, the agency found that commercially available necks either cannot meet or cannot consistently meet all of the calibration tests originally proposed for the neck. To further evaluate this problem, NHTSA and GM conducted a series of round robin tests in which a set of test dummies were put through the calibration tests at both GM's and NHTSA's test laboratories.

The test results, which were placed in the docket after the tests were completed, showed that none of the necks could pass all of the originally specified calibration tests.

In examining the test data, the agency determined that while some of the responses of the necks fell slightly outside of the performance corridors proposed in the calibration tests, the responses of the necks showed a relatively good match to existing biomechanical data on human neck responses. Thus, while the necks did not meet all of the calibration tests, they did respond as human necks are expected to respond.

In discussions with GM, the agency learned that the calibration performance requirements were originally established in 1977 based on the responses of three prototype Hybrid III necks. GM first examined the existing biomechanical data and established several performance criteria that reflected human neck responses. GM then built necks which would meet the biomechanically based performance criteria. GM established the calibration tests that it believed were necessary to ensure that the necks of the prototype test dummies would produce the required biomechanical responses. Although extensive performance specifications may have been needed for the development of specially built prototype necks, not all of the specifications appear to be essential once the final design was established for the mass-produced commercial version. Based on the ability of the commercially available test dummies to meet the biomechanical response criteria, NHTSA believes that the GM-

derived calibration requirements should be adjusted to reflect the response characteristics of commercially available test dummies and simplified as much as possible to reduce the complexity of the testing.

Based on the results of the NHTSA-GM calibration test series, the agency is making the following changes to the neck calibration tests. In the flexion (forward bending) calibration test, the agency is:

1. increasing the time allowed for the neck to return to its preimpact position after the pendulum impact test from a range of 109–119 milliseconds to a range of 113–128 milliseconds.

2. changing the limits for maximum head rotation from a range of 67°–79° to a range of 64°–78°.

3. expanding the time limits during which maximum moment must occur from a range of 46–56 milliseconds to 47–58 milliseconds.

4. modifying the limits for maximum moment from a range of 72–90 ft-lbs to a range of 65–80 ft-lbs.

5. increasing the time for the maximum moment to decay from a range of 95–105 milliseconds to a range of 97–107 milliseconds.

In the extension (backward bending) calibration test, the agency is:

1. expanding the time allowed for the neck to return to its preimpact position after the pendulum impact test from a range of 157–167 milliseconds to a range of 147–174 milliseconds.

2. changing the limits for maximum head rotation from a range of 94°–106° to a range of 81°–106°.

3. expanding the time limit during which the minimum moment must occur from a range of 69–77 milliseconds to 65–79 milliseconds.

4. modifying the limits for minimum moment from a range of –52 to –63 ft-lbs to a range of –39 to –59 ft-lbs.

5. increasing the time for the minimum moment to decay from the range of 120–144 milliseconds, contained in GM's technical specifications for the Hybrid III, to a range of 120–148 milliseconds.

In reviewing the NHTSA-GM test data, the agency also identified several ways of simplifying the neck's performance requirements. In each case, the following calibration specifications appear to be redundant and their deletion should not affect the performance of the neck. The agency has thus deleted the requirement for minimum moment in flexion and the time requirement for that moment. For extension, the agency has eliminated the limit on the maximum moment permitted and the time requirement for that moment. The agency has deleted those requirements since the specification on maximum rotation of the neck in flexion and minimum rotation of the neck in extension appear to adequately measure the same properties of the neck. Similarly, the agency has simplified the test by eliminating the pendulum braking requirement for the neck test, since GM's testing shows that the requirement is not necessary to ensure test consistency. Finally, the agency is clarifying the test procedure by deleting the specification in the GM technical drawings for the Hybrid III calling for two pre-calibration impact tests of the neck. GM has informed the agency that the two pre-calibration tests are not necessary.

Based on the NHTSA-GM calibration test data, the agency is making two additional changes to the neck calibration test procedure. Both NHTSA and GM routinely control the calibration pendulum impact speed to within plus or minus one percent. Currently available dummy necks are able to meet the calibration response requirements consistently when the pendulum impact speed is controlled to that level Thus, NHTSA believes that the proposed range of allowable velocities (± 8.5 percent) for the pendulum impact is excessive. Reducing the allowable range is clearly feasible and will help maintain a high level of consistency in dummy neck responses. The agency has therefore narrowed the range of permissible impact velocities to the neck to ± 2 percent. This range is readily obtainable with commercially available test equipment. In reviewing the neck calibration test data, GM and NHTSA noted a slight sensitivity in the neck response to temperature variation. In its docket submission of January 27, 1986, GM recommended controlling the temperature during the neck calibration test to 71° ± 1°. NHTSA agrees that controlling the temperature for the neck calibration test will reduce variability, but the agency believes that a slightly wider temperature range of 69° to 72°, which is the same range used in the chest calibration test, is sufficient.

Neck Durability

Nissan commented that, in sled tests of the two test dummies, the neck bracket of one of the Hybrid III test dummies experienced damage after 10 tests, while the Part 572 test dummy had no damage. The agency believes that Nissan's experience may be the result of an early neck design which has been subsequently modified by GM. (See GM letter of September 16, 1985, Docket 74-14, Notice 39, Entry 28.) The agency has conducted numerous 30 mile per hour vehicle impact tests using the Hybrid III test dummy and has not had any neck bracket failures.

Thorax Calibration Test

As a part of the NHTSA-GM calibration test series, both organizations also performed the proposed calibration test for the thorax on the same test dummies. That testing showed relatively small differences in the test results measured between the two test facilities The test results from both test facilities show that the chest responses of the Hybrid III test dummies were generally within the established biomechanical performance corridors for the chest. In addition, the data showed that the Hybrid III chest responses fit those corridors substantially better than the chest responses of the existing Part 572 test dummy. The data also showed that the chest responses in the high speed (22 ft/sec) pendulum impact test more closely fit the corridors than did the chest responses in the low speed (14 ft/sec) test. In addition, the data showed that if a test dummy performed satisfactorily in the low speed pendulum impact test, it also performed satisfactorily in the more severe high speed test.

Based on those results, GM recommended in a letter of January 27, 1986, (Docket No. 74-14, Notice 39, Entry 41) that only the low speed pendulum impact be used in calibration testing of the Hybrid III chest. GM noted that deleting the more severe pendulum impact test "can lead to increasing the useful life of the chest structure."

Based on the test data, the agency agrees with the GM recommendation that only one pendulum impact test is necessary. NHTSA recognizes that using only the low speed pendulum impact will increase the useful life of the chest. However, the agency has decided to retain the high speed rather than the low speed test. While NHTSA recognizes that the high speed test is more severe, the agency believes the high speed test is more appropriate for a number of reasons. First, the data showed that the high speed chest impact responses compared more closely with the biomechanical corridors than the low speed responses. Thus, use of the high speed test will make it easier to identify chests that do not have the correct biofidelity. In addition, since the higher speed test is more severe it will subject the ribcage to higher stresses, which will help identify chest structural degradation. Finally, the high speed impact test is more representative of the range of impacts a test dummy can receive in a vehicle crash test.

Although the NHTSA-GM test data showed that the production version of the Hybrid III chest had sufficient biofidelity, the data indicated that proposed calibration performance requirements should be lightly changed to account for the wider range in calibration test responses measured in commercially available test dummies. Accordingly, the agency is adjusting the chest deflection requirement to increase the allowable range of deflections from 2.51–2.75 inches to 2.5–2.85 inches. In addition, the agency is adjusting the resistive force requirement from a range of 1186–1298 pounds to a range of 1080–1245 pounds. Also, the hysteresis requirement is being adjusted from a 75–80 percent range to a 69–85 percent range. Finally, the agency is clarifying the chest calibration test procedure by deleting the specification in GM's technical drawing for the Hybrid III that calls for two pre-calibration impact tests of the chest. GM has informed the agency that these tests are not necessary. These slight changes will not affect the performance of the Hybrid III chest, since the NHTSA-GM test data showed that commercially available test dummies meeting these calibration specifications had good biofidelity.

Chest Durability

Testing done by the agency's Vehicle Research and Test Center has indicated that the durability of the Hybrid III's ribs in calibration testing is less than that of the Part 572 test dummy. ("State-of-the-Art Dummy Selection, Volume I" DOT Publication No. HS 806 722) The durability of the Hybrid III was also raised by several commenters. For example, Toyota raised questions about the durability of the Hybrid III's ribs and suggested the agency act to improve their durability.

The chest of the Hybrid III is designed to be more flexible, and thus more human-like, than the chest of the Part 572 test dummy. One of the calibration tests used for the chest involves a 15 mph impact into the chest by a 51.5 pound pendulum; an impact condition which is substantially more severe than a safety belt or airbag restrained occupant would experience in most crashes. The chest of the Hybrid III apparently degrades after such multiple impacts at a faster rate than the chest of the Part 572 test dummy. As the chest gradually deteriorates, the amount of acceleration and deflection measured in the chest are also affected. Eventually the chest will fall out of specification and will require either repair or replacement.

In its supplemental comments to the April 1985 notice, GM provided additional information about the durability of the Hybrid III ribs. GM said that it uses the Hybrid III in unbelted testing, which is the most severe test for the dummy. GM said that the Hybrid III can be used for about 17 crash tests before the ribs must be replaced. GM explained

that it does not have comparable data for the Part 572 test dummy since it does not use that test dummy in unbelted tests. GM said, however, that it believes that the durability of the Part 572 test dummy ribs in vehicle crash testing would be comparable to that of the Hybrid III.

Having reviewed all the available information, the agency concludes that both the Hybrid III and existing Part 572 test dummy ribs will degrade under severe impact conditions. Although the Hybrid III's more flexible ribs may need replacement more frequently, particularly after being used in unrestrained testing, the Hybrid III's ribs appear to have reasonable durability. According to GM's data, which is in line with NHTSA's crash test experience, the Hybrid III's ribs can withstand approximately 17 severe impacts, such as found in unrestrained testing, before they must be replaced. Ford, in a presentation at the MVMA Hybrid III workshop held on February 5, 1986, noted that one of its belt-restrained Hybrid III test dummies was subjected to 35 vehicle and sled crashes without any failures. The potential lower durability of the ribs in unrestrained testing should be of little consequence if the Hybrid III test dummy is used in air bag or belt testing.

Chest Temperature Sensitivity

The April 1985 notice said NHTSA tests have indicated that the measurements of chest deflection and chest acceleration by the Hybrid III are temperature sensitive. For this reason, GM's specifications for the Hybrid III recognize this problem and call for using the test dummy in a narrower temperature range (69° to 72° F) to ensure the consistency of the measurements. GM has also suggested the use of an adjustment factor for calculating chest deflection when the Hybrid III is used in a test environment that is outside of the temperature range specified for the chest. While this approach may be reasonable to account for the adjustment of the deflection measurement, there is no known method to adjust the acceleration measurement for variations in temperature. For this reason, the agency is not adopting GM's proposed adjustment factor, but is instead retaining the proposed 69° to 72° F temperature range.

A number of commenters addressed the feasibility and practicability of maintaining that temperature range. BMW said that although it has an enclosed crash test facility, it had reservations about its ability to control the test temperature within the proposed range. Daihatsu said that it was not sure it could assure the test dummy's temperature will remain within the proposed range. Honda said that while it had no data on the temperature sensitivity of the Hybrid III, it questioned whether the proposed temperature range was practical. Mercedes-Benz said it is not practicable to maintain the proposed temperature range because the flood lights necessary for high speed filming of crash tests can cause the test dummy to heat up. Nissan said it was not easy to maintain the current 12 degree range specified for the existing Part 572 test dummy and thus it would be hard to maintain the three degree range proposed for the Hybrid III. Ford also said that maintaining the three degree range could be impracticable in its current test facilities.

Other manufacturers tentatively indicated that the proposed temperature range may not be a problem. VW said the temperature range should not be an insurmountable problem, but more experience with the Hybrid III is necessary before any definite conclusions can be reached. Volvo said it could maintain the temperature range in its indoor test facilities, but it questioned whether outdoor test facilities could meet the proposed specification. Humanoid indicated in its comments, that it has developed an air conditioning system individualized for each test dummy which will maintain a stable temperature in the test dummy up to the time of the crash test.

The agency believes that there are a number of effective ways to address the temperature sensitivity of the Hybrid III chest. The test procedure calls for placing the test dummy in an area, such as a closed room, whose temperature is maintained within the required range for at least four hours before either the calibration tests or the use of the test dummy in a crash test. The purpose of the requirement is to ensure that the primary components of the test dummy have reached the correct temperature before the test dummy is used in a test. As discussed below, analytical techniques can be used to determine the temperature within the test dummy, to calculate how quickly the test dummy must be used in a crash test before its temperature will fall outside the required temperature range.

Testing done by the agency with the current Part 572 test dummy, whose construction and materials are similar to the Hybrid III, has determined how long it takes for various test dummy components to reach the required temperature range once the test dummy is placed in a room within that range. ("Thermal Responses of the Part 572 Dummy to Step Changes in Ambient Temperature" DOT Publication No. HS-801 960, June 1976) The testing was done by placing thermocouples, devices to

measure temperature, at seven locations within the dummy and conducting a series of heating and cooling experiments. The tests showed that the thermal time constants (the thermal time constant is the time necessary for the temperature differential between initial and final temperatures to decrease from its original value to 37% of the original differential) varied from 1.2 hours for the forehead to 6.2 hours for the lumbar spine. Using this information it is possible to estimate the time it takes a test dummy originally within the required temperature range to fall out of the allowable range once it has been exposed to another temperature. The rib's thermal time constant is 2.9 hours. This means, for example, that if a test dummy's temperature has been stabilized at 70.5° F and then transferred to a test environment at 65° F, it would take approximately 0.8 hours for the rib temperature to drop to 69° F, the bottom end of the temperature range specified in Part 572.

Thus, the NHTSA test results cited above show that the chest can be kept within the range proposed by the agency if the test dummy is placed in a temperature-controlled environment for a sufficient time to stabilize the chest temperature. Once the chest of the test dummy is at the desired temperature, the test data indicate that it can tolerate some temperature variation at either an indoor or outdoor crash test site and still be within the required temperature range as long as the crash test is performed within a reasonable amount of time and the temperature at the crash site, or within the vehicle, or within the test dummy is controlled close to the 69 to 72 degrees F range. Obviously, testing conducted at extremely high or low temperatures can move the test dummy's temperature out of the required range relatively quickly, if no means are used to maintain the temperature of the test dummy within the required range. However, auxiliary temperature control devices can be used in the vehicle or the test environment to maintain a stabilized temperature prior to the crash test. Therefore, the agency has decided to retain the proposed 69 to 72 degrees F temperature range.

Chest Response to Changes in Velocity

The April notice raised the issue of the sensitivity of the Hybrid III's chest to changes in impact velocities. The notice pointed out that one GM study on energy-absorbing steering columns ("Factors Influencing Laboratory Evaluation of Energy-Absorbing Steering Systems," Docket No. 74-14, Notice 32, Entry 1666B) indicated that the Hybrid III's chest may be insensitive to changes in impact velocities and asked commenters to provide further information on this issue.

Both GM and Ford provided comments on the Hybrid III's chest response. GM said that since the Hybrid III chest is designed to have a more human-like thoracic deflection than the Part 572 test dummy, the Hybrid III's response could be different. GM referenced a study ("System Versus Laboratory Impact Tests for Estimating Injury Hazard" SAE paper 680053) which involved cadaver impacts into energy-absorbing steering columns. The study concluded that the force on the test subject by the steering assembly was relatively constant despite changes in test speeds. GM said that this study indicated that "rather than the Hybrid III chest being insensitive to changes in velocity in steering system tests, it is the Part 572 which is too sensitive to changes in impact velocity to provide meaningful information for evaluating steering systems."

GM also presented new data on chest impact tests conducted on the Hybrid III and Part 572 test dummies. The tests involved chest impacts by three pendulum impact devices with different masses and three impact speeds. GM said that the test results show that "the Hybrid III chest deflection is sensitive to both changes in impact velocity and impactor mass." Ford also noted that the Hybrid III appears sensitive in the range of speed and deflections that are relevant to Standard No. 208 testing with belt-restrained dummies.

Ford noted that the GM testing referenced in the April notice was conducted at higher impact speeds than used in the calibration testing of the Hybrid III. Ford said it agreed with GM that the indicated insensitivity of chest acceleration to speed and load is a reflection of the constant-force nature of the steering column's energy absorption features. After reviewing the information provided by Ford and GM, NHTSA agrees that in an impact with a typical steering column, once the energy-absorbing mechanism begins to function, the test dummy's chest will receive primarily constant force. The lower stiffness of the Hybrid III chests would make it respond in a more human-like manner to these forces than the existing Part 572 test dummy.

Chest Accelerometer Placement

Volvo pointed out that the chest accelerometer of the Hybrid III is located approximately at the center of gravity of the chest, while the accelerometer is higher and closer to the back in the Part 572 test dummy. Volvo said that since the biomechanical tolerance limits for the chest were established using a location similar to that in the Part 572, it

questioned whether the acceleration limits should apply to the Hybrid III. Volvo recommended changing the location of the accelerometer in the Hybrid III or using different chest acceleration criteria for the Hybrid III.

The agency recognizes that Hybrid III accelerometer placement should more correctly reflect the overall response of the chest because it is placed at the center of gravity of the chest. However, the dimensional differences between the accelerometer placements in the two test dummies are so small that in restrained crash tests the differences in acceleration response, if any, should be minimal.

Repeatability and Reproducibility

As discussed previously, test dummy repeatability refers to the ability of one test dummy to measure consistently the same responses when subjected to the same test. Reproducibility refers to the ability of two or more test dummies built to the same specifications to measure consistently the same responses when they are subjected to the same test.

Ford said that it is particularly concerned about the repeatability of the chest acceleration and deflection measurements of the Hybrid III and about the reproducibility of the Hybrid III in testing by different laboratories. Ford said that once a test dummy positioning procedure has been established, the agency should conduct a series of 16 car crash tests to verify the repeatability and reproducibility of the Hybrid III.

In its comments, GM provided data showing that the repeatability of the Hybrid III is the same as the existing Part 572 test dummy. Volvo, the only other commenter that addressed repeatability, also said that its preliminary tests show that the Hybrid III has a repeatability comparable to the Part 572. The agency's Vehicle Research and Test Center has also evaluated the repeatability of the Hybrid III and the Part 572 in a series of sled tests. The data from those tests show that the repeatability of the two test dummies is comparable. ("State-of-the-Art Dummy Selection, Volume I" DOT Publication No. HS 806 722.)

GM also provided data showing that the reproducibility of the Hybrid III is significantly better than the Part 572. In its supplemental comments filed on September 16, 1985, GM also said that Ford's proposed 16 car test program was not needed. GM said that "in such test the effects of vehicle build variability and test procedure variability would totally mask any effect of Hybrid III repeatability and reproducibility."

The agency agrees with GM that additional testing is unnecessary. The information Provided by GM and Volvo shows that the repeatability of the Hybrid III is at least as good as the repeatability of the existing Part 572 test dummy. Likewise, the GM data show that the reproducibility of the Hybrid III is better than that of the existing Part 572 test dummy. Likewise, the recent NHTSA-GM calibration test series provides further confirmation that tests by different laboratories show the repeatability and reproducibility of the Hybrid III.

Equivalence of Hybrid III and Part 572

As noted in the April 1985 notice, the Hybrid III and the Part 572 test dummies do not generate identical impact responses. Based on the available data, the agency concluded that when both test dummies are tested in lap/shoulder belts or with air cushions, the differences between the two test dummies are minimal. The agency also said that it knew of no method for directly relating the response of the Hybrid III to the Part 572 test dummy.

The purpose of comparing the response of the two test dummies is to ensure that the Hybrid III will meet the need for safety by adequately identifying vehicle designs which could cause or increase occupant injury. The agency wants to ensure that permitting a choice of test dummy will not lead to a degradation in safety performance.

As mentioned previously, one major improvement in the Hybrid III is that it is more human-like in its responses than the current Part 572 test dummy. The primary changes to the Hybrid III that make it more human-like are to the neck, chest and knee. Comparisons of the responses of the Part 572 and Hybrid III test dummies show that responses of the Hybrid III are closer than the Part 572 to the best available data on human responses. (See Chapter II of the Final Regulatory Evaluation on the Hybrid III.)

In addition to being more human-like, the Hybrid III has increased measurement capabilities for the neck (tension, compression, and shear forces and bending moments), chest (deflection), knee (knee shear), and lower leg (knee and tibia forces and moments). The availability of the extra injury measuring capability of the Hybrid III gives vehicle manufacturers the potential for gathering far more information about the performance of their vehicle designs than they can obtain with the Part 572.

To evaluate differences in the injury measurements made by the Hybrid III and the existing Part 572 test dummy, the agency has reviewed all of the available data comparing the two test dummies. The data come from a variety of sled

barrier crash tests conducted by GM, Mercedes-Benz, NHTSA, Nissan, and Volvo. The data include tests where the dummies were unrestrained and tests where the dummies were restrained by manual lap/shoulder belts, automatic belts, and air bags. For example, subsequent to issuance of the April 1985 notice, NHTSA did additional vehicle testing to compare the Part 572 and Hybrid III test dummies. The agency conducted a series of crash tests using five different types of vehicles to measure differences in the responses of the test dummies. Some of the tests were frontal 30 mile per hour barrier impacts, such as are used in Standard No. 208 compliance testing, while others were car-to-car tests. All of the tests were done with unrestrained test dummies to measure their impact responses under severe conditions. The agency's analysis of the data for all of the testing done by NHTSA and others is fully described in the Final Regulatory Evaluation for this rulemaking. This notice will briefly review that analysis.

One of the reasons for conducting the analysis was to address the concern raised by the Center for Auto Safety (CAS) in its original petition and the Insurance Institute for Highway Safety (IIHS) in its comments that the Hybrid III produces lower HIC responses than the existing Part 572 test dummy. As discussed in detail below, the test data do not show a trend for one type of test dummy to consistently measure higher or lower HIC's or femur readings than the other. Based on these test data, the agency concludes that the concern expressed by CAS and IIHS that the use of the Hybrid III test dummy will give a manufacturer an advantage in meeting the HIC performance requirement of Standard No. 208 is not valid.

In the case of chest acceleration measurements, the data again do not show consistently higher or lower measurements for either test dummy, except in the case of unrestrained tests. In unrestrained tests, the data show that the Hybrid III generally measures lower chest g's than the existing Part 572 test dummy. This difference in chest g's measurement is one reason why the agency is adopting the additional chest deflection measurement for the Hybrid III, as discussed further below.

HIC Measurements

The April 1985 notice specifically invited comments on the equivalence of the Head Injury Criterion (HIC) measurements of the two test dummies. Limited laboratory testing done in a University of California at San Diego study conducted by Dr. Dennis Schneider and others had indicated that the Hybrid III test dummy generates lower acceleration responses than either the Part 572 test dummy or cadaver heads in impacts with padded surfaces. The notice explained that the reasons for those differences had not yet been resolved.

In its comments, GM explained that it had conducted a series of studies to address the Schneider results. GM said that those studies showed that the Schneider test results are "complicated by the changing characteristics of the padding material used on his impact surface. As a result, his tests do not substantiate impactor response difference between the Hybrid III head, the Part 572 head and cadaver heads. After examining our reports, Dr. Schneider agreed with the finding that padding degradation resulting from multiple impact exposures rendered an input-response comparison invalid between the cadaver and the dummies." (The GM and Schneider letters are filed in Docket 74-14, General Reference, Entry 556.)

The agency's Vehicle Research and Test Center has also conducted head drop tests of the current Part 572 and Hybrid III heads. The tests were conducted by dropping the heads onto a two inch thick steel plate, a surface which is considerably more rigid than any surface that the test dummy's head would hit in a vehicle crash test. One purpose of the tests was to assess the performance of the heads in an impact which can produce skull fractures in cadavers. The tests found that the response of the Hybrid III head was more human-like at the fracture and subfracture acceleration levels than the Part 572 head. The testing did show that in these severe impacts into thick steel plates, the HIC scores for the Hybrid III were lower than for the Part 572. However, as discussed below, when the Hybrid III is tested in vehicle crash and sled tests, which are representative of occupant impacts into actual vehicle structures, the HIC scores for the Hybrid III are not consistently lower than those of the Part 572 test dummy.

The agency examined crash and sled tests, done by GM, Mercedes-Benz, NHTSA and Volvo, in which both a Hybrid III and the existing Part 572 test dummy were restrained by manual lap/shoulder belts. (The complete results from those and all the other tests reviewed by the agency are discussed in Chapter III of the Final Regulatory Evaluation on the Hybrid III.) The HIC responses in those tests show that the Hybrid III generally had higher HIC responses than the Part 572 test dummy. Although the data show that the Hybrid III's HIC responses are generally higher, in some cases 50 percent higher than the Part 572, there are some tests in which the Hybrid III's responses were 50 percent lower than the responses of the Part 572.

For two-point automatic belts, the agency has limited barrier crash test data and the direct comparability of the data is questionable. The tests using the existing Part 572 test dummy were done in 1976 on 1976 VW Rabbits for compliance purposes. The Hybrid III tests were done in 1985 by the agency's Vehicle Research and Test Center as part of the SRL-98 test series on a 1982 and a 1984 VW Rabbit. Differences in the seats, safety belts, and a number of other vehicle parameters between these model years and between the test set-ups could affect the results. In the two-point automatic belt tests, the data show that the Hybrid III measured somewhat higher head accelerations than the existing Part 572 test dummy. In two-point automatic belts, the differences appear to be minimal for the driver and substantially larger for the passenger. In air bag sled tests, the Hybrid III's HIC responses were generally lower; in almost all the air bag tests, the HIC responses of both the Hybrid III and the Part 572 test dummies were substantially below the HIC limit of 1,000 set in Standard No. 208. Because of the severe nature of the unrestrained sled and barrier tests, in which the uncontrolled movement of the test dummy can result in impacts with different vehicle structures, there was no consistent trend for either test dummy to measure higher or lower HIC responses than the other.

Chest Measurements

For manual lap/shoulder belts, NHTSA compared the results from GM, Mercedes-Benz, NHTSA, and Volvo sled tests, and GM frontal barrier tests. The NHTSA sled test results at 30 and the Volvo sled test results at 31 mph are very consistent, with the mean Hybrid III chest acceleration response being only 2–3 g's higher than the response of the existing Part 572 test dummy. In the 35 mph Volvo sled tests, the Hybrid III chest acceleration response was up to 44 percent higher than the existing Part 572 response. The GM 30 mph sled and barrier test data were fairly evenly divided. In general, the Hybrid III chest acceleration response is slightly higher than that of the existing Part 572 test dummy. The agency concludes from these data that at Standard No. 208's compliance test speed (30 mph) with manual lap/shoulder belts there are no large differences in chest acceleration responses between the two dummies. In some vehicles, the Hybrid III may produce slightly higher responses and in other vehicles it may produce slightly lower responses.

As discussed earlier, the agency has limited test data on automatic belt tests and their comparability is questionable. The Hybrid III chest acceleration responses are up to 1.5 times higher than those for the existing Part 572 test dummy. Only very limited sled test data are available on air bags alone, air bag plus lap belt, and air bag plus lap/shoulder belt. In all cases, the Hybrid III chest acceleration responses were lower than those for the existing Part 572 test dummy.

For unrestrained occupants, the Hybrid III produces predominantly lower chest acceleration responses than the existing Part 572 test dummy in sled and barrier tests, and in some cases the difference is significant. In some tests, the Hybrid III chest acceleration response can be 40 to 45 percent lower than the Part 572 response, although in other tests the acceleration measured by the Hybrid III can exceed that measured by the Part 572 test dummy by 10 to 15 percent.

In summary, the test data indicate the chest acceleration responses between the Hybrid III and the existing Part 572 test dummy are about the same for restrained occupants, but differ for some cases of unrestrained occupants. This is to be expected since a restraint system would tend to make the two dummies react similarly even though they have different seating postures. The different seating postures, however, would allow unrestrained dummies to impact different vehicle surfaces which would in most instances produce different responses. Since the Hybrid III dummy is more human-like, it should experience loading conditions that are more human-like than would the existing Part 572 test dummy. One reason that the agency is adding a chest deflection criterion for the Hybrid III is that the unrestrained dummy's chest may experience more severe impacts with vehicle structures than would be experienced in an automatic belt or air bag collision. Chest deflection provides an additional measurement of potential injury that may not be detected by the chest acceleration measurement.

Femur Measurements

The test data on the femur responses of the two types of test dummies also do not show a trend for one test dummy to measure consistently higher or lower responses than the other. In lap/shoulder belt tests, GM's sled and barrier tests from 1977 show a trend toward lower measurements for the Hybrid III, but GM's more recent tests in 1982–83 show the reverse situation. These tests, however, are of little significance unless there is femur loading due to knee contact. These seldom occur to lap/shoulder belt restrained test dummies. Also, in none of the tests described above do the measurements approach Standard No. 208's limit of 2250 pounds for femur

loads. The air bag test data are limited; however, they show little difference between the femur responses of the two test dummies. As would be expected, the unrestrained tests showed no systematic differences, because of the variability in the impact locations of an unrestrained test dummy.

Injury Criteria

Many manufacturers raised objections to the additional injury criteria proposed in the April 1985 notice. AMC, Ford, and MVMA argued that adopting the numerous injury criteria proposed in the April 1985 notice would compound a manufacturer's compliance test problems. For example, Ford said it "would be impracticable to require vehicles to meet such a multitude of criteria in a test with such a high level of demonstrated variability. Notice 39 appears to propose 21 added pass-fail measurements per dummy, for a total of 25 pass-fail measurements per dummy, or 50 pass-fail measurements per test. Assuming these measurements were all independent of one another, and a car design had a 95% chance of obtaining a passing score on each measurement, the chance of obtaining a passing score on all measurements in any single test for a single dummy would be less than 28% and for both dummies would be less than 8%." Ford, Nissan, VW and Volvo also said that with the need for additional measurements, there will be an increase in the number of tests with incomplete data. BMW, while supporting the use of the Hybrid III as a potential improvement to safety, said that the number of measurements needed for the additional injury criteria is beyond the capability of its present data processing equipment.

VW said there is a need to do additional vehicle testing before adopting any new criteria. It said that if current production vehicles already meet the additional criteria then the criteria only increase testing variability without increasing safety. If current vehicles cannot comply, then additional information is needed about the countermeasures needed to meet the criteria. Honda said there are insufficient data to determine the relationship between actual injury levels and the proposed injury criterion.

As discussed in detail below, the agency has decided to adopt only one additional injury criterion, chest deflection, at this time. The agency plans to issue another notice on the remaining criteria proposed in the April 1985 notice to gather additional information on the issues raised by the commenters.

Alternative HIC Calculations

The April 1985 notice set forth two proposed alternative methods of using the head injury criterion (HIC) in situations when there is no contact between the test dummy's head and the vehicle's interior during a crash. The first proposed alternative was to retain the current HIC formula, but limit its calculation to periods of head contact only. However, in non-contact situations, the agency proposed that an HIC would not be calculated, but instead new neck injury criteria would be calculated. The agency explained that a crucial element necessary for deciding whether to use the HIC calculation or the neck criteria was an objective technique for determining the occurrence and duration of head contact in the crash test. As discussed in detail in the April 1985 notice, there are several methods available for establishing the duration of head contact, but there are questions about their levels of consistency and accuracy.

The second alternative proposed by the agency would have calculated an HIC in both contact and non-contact situations, but it would limit the calculation to a time interval of 36 milliseconds. Along with the requirement that an HIC not exceed 1,000, this would limit average head acceleration to 60 g's or less for any durations exceeding 36 milliseconds.

Almost all of the commenters opposed the use of the first proposed alternative. The commenters uniformly noted that there is no current technique that can accurately identify whether head contact has or has not occured during a crash test in all situations. However, the Center for Auto Safety urged the agency to adopt the proposed neck criteria, regardless of whether the HIC calculation is modified.

There was a sharp division among the commenters regarding the use of the second alternative; although many manufacturers argued that the HIC calculation should be limited to a time interval of approximately 15 to 17 milliseconds (ms), which would limit average long duration (i.e., greater than 15–17 milliseconds) head accelerations to 80–85 g's. Mercedes-Benz, which supported the second alternative, urged the agency to measure HIC only during the time interval that the acceleration level in the head exceeds 60 g's. It said that this method would more effectively differentiate results received in contacts with hard surfaces and results obtained from systems, such as airbags, which provide good distribution of the loads experienced during a crash. The Center for Auto Safety, the Insurance Institute for Highway Safety and State Farm argued that the current HIC calculation should be retained; they said that the proposed alternative would lower HIC calculations without ensuring that motorists were still receiving adequate head protection.

NHTSA is in the process of reexamining the potential effects of the two alternatives proposed by the agency and of the two additional alternatives suggested by the commenters. Once that review has been completed, the agency will issue a separate notice announcing its decision.

Thorax

At present, Standard No. 208 uses an acceleration-based criterion to measure potential injuries to the chest. The agency believes that the use of a chest deflection criterion is an important supplement to the existing chest injury criterion. Excessive chest deflection can produce rib fractures, which can impair breathing and inflict damage to the internal organs in the chest. The proposed deflection limit would only apply to the Hybrid III test dummy, since unlike the existing Part 572 test dummy, it has a chest which is designed to deflect like a human chest and has the capability to measure deflection of the sternum relative to the spine, as well as acceleration, during an impact.

The agency proposed a three-inch chest deflection limit for systems, such as air bags, which symmetrically load the chest during a crash and a two-inch limit for all other systems. The reason for the different proposed limits is that a restraint system that symmetrically and uniformly applies loads to the chest increases the ability to withstand chest deflection as measured by the deflection sensor, which is centrally located in the dummy.

The commenters generally supported adoption of a chest deflection injury criterion. For example, Ford said it supported the use of a chest deflection criterion since it may provide a better means of assessing the risk of rib fractures. Likewise, the Insurance Institute for Highway Safety said the chest deflection criteria "will aid in evaluating injury potential especially in situations where there is chest contact with the steering wheel or other interior components." IIHS also supported adoption of a three-inch deflection limit for inflatable systems and a two-inch limit for all other systems. However, most of the other commenters addressing the proposed chest deflection criteria questioned the use of different criteria for different restraint systems.

GM supported limiting chest deflections to three-inches in all systems. GM said that it uses a two-inch limit as a guideline for its safety belt system testing, but it had no data to indicate that the two-inch limit is appropriate as a compliance limit.

Renault/Peugeot also questioned the three-inch deflection limit for systems that load the dummy symmetrically and two inches for systems that do not. It said that the difference between those systems should be addressed by relocation of the deflection sensors. It also asked the agency to define what constitutes a symmetrical system. VW also questioned the appropriateness of setting separate limits for chest compression for different types of restraint systems. It recommended adoption of a three-inch limit for all types of restraint systems.

Volvo also raised questions about the appropriateness of the proposed deflection criteria. Volvo said that the GM-developed criteria proposed in the April 1985 notice were based on a comparison of accident data gathered by Volvo and evaluated by GM in sled test simulations using the Hybrid III test dummy. Volvo said that the report did not analyze "whether the chest injuries were related to the chest acceleration or the chest deflection, or a combination of both."

The agency recognizes that there are several different types of potential chest injury mechanisms and that it may not be possible to precisely isolate and measure what is the relevant contribution of each type of mechanism to the final resulting injury. However, there is a substantial amount of data indicating that chest deflection is an important contributing factor to chest injury. In addition, the data clearly demonstrate that deflection of greater than three inches can lead to serious injury. For example, research done by Neathery and others has examined the effects of frontal impacts to cadaver chests with an impactor that represents the approximate dimensions of a steering wheel hub. Neathery correlated the measured injuries with the amount of chest deflection and recommended that for a 50th percentile male, chest deflection not exceed three inches. (Neathery, R. F., "Analysis of Chest Impact Response Data and Scaled Performance Recommendations," SAE Paper No. 741188)

Work by Walfisch and others looked at crash tests of lap/shoulder belt restrained cadavers. They found that substantial injury began to occur when the sternum deflection exceeded 30 percent of the available chest depth ("Tolerance Limits and Mechanical Characteristic of the Human Thorax in Frontal and Side Impact and Transposition of these Characteristics into Protective Criteria," 1982 IRCOBI Conference Proceedings). With the chest of the average man being approximately 9.3 inches deep, the 30 percent limit would translate into a deflection limit of approximately 2.8 inches. Since the chest of the Hybrid III test dummy deflects somewhat less than a human chest under similar loading conditions, the chest deflection limit for systems which do not symmetrically and uniformly

load the chest, such as lap/shoulder belts, must be set at a level below 2.8 inches to assure an adequate level of protection.

To determine the appropriate level for non-symmetrical systems, the agency first reviewed a number of test series in which cadaver injury levels were measured under different impact conditions. (All of the test results are fully discussed in Chapter III of the Final Regulatory Evaluation on the Hybrid III.) The impact conditions included 30 mph sled tests done for the agency by Wayne State University in which a pre-inflated, non-vented air bag system symmetrically and uniformly spread the impact load on the chest of the test subject. NHTSA also reviewed 30 mph sled tests done for the agency by the University of Heidelberg which used a lap/shoulder belt system, which does not symmetrically and uniformly spread chest loads. In addition, the agency reviewed 10 and 15 mph pendulum impact tests done for GM to evaluate the effects of concentrated loadings, such as might occur in passive interior impacts. The agency then compared the chest deflection results for Hybrid III test dummies subjected to the same impact conditions. By comparing the cadaver and Hybrid III responses under identical impact conditions, the agency was able to relate the deflection measurements made by the Hybrid III to a level of injury received by a cadaver.

The test results show that when using a relatively stiff air bag, which was pre-inflated and non-vented, the average injury level measured on the cadavers corresponded to an Abbreviated Injury Scale (AIS) of 1.5. (The AIS scale is used by researchers to classify injuries an AIS of one is a minor injury, while an AIS of three represents a serious injury.) In tests with the Hybrid III under the same impact conditions, the measured deflection was 2.7 inches. These results demonstrate that a system that symmetrically and uniformly distributes impact loads over the chest can produce approximately threeinches of deflection and still adequately protect an occupant from serious injury.

The testing in which the impact loads were not uniformly or symmetrically spread on the chest or were highly concentrated over a relatively small area indicated that chest deflection measured on the Hybrid III must be limited to 2-inches to assure those systems provide a level of protection comparable to that provided by systems that symmetrically spread the load. In the lap/shoulder belt tests, the average AIS was 2.6. The measured deflection for the Hybrid III chest in the same type of impact test was 1.6 inches. Likewise, the results from the pendulum impact tests showed that as the chest deflection measured on the Hybrid III increased, the severity of the injuries increased. In the 10 mph pendulum impacts, the average AIS was 1.3 and the average deflection was 1.3 inches. In the 15 mph pendulum impacts the average AIS rose to 2.8. Under the same impact conditions, the chest deflection measured on the Hybrid III was 2.63 inches.

Based on these test results NHTSA has decided to retain the two-inch limit on chest deflection for systems that do not symmetrically and uniformly distribute impact loads over a wide area of the chest. Such systems include automatic safety belts, passive interiors and air bag systems which use a lap and shoulder belt. For systems, such as air bag only systems or air bag combined with a lap belt, which symmetrically and uniformly distribute chest forces over a large area of the chest, the agency is adopting the proposed three-inch deflection limit. This should assure that both symmetrical and non-symmetrical systems provide the same level of protection in an equivalent frontal crash.

In addition to the biomechanical basis for the chest deflection limits adopted in this notice, there is another reason for adopting a two-inch deflection limit for systems that can provide concentrated loadings over a limited area of the test dummy. The Hybrid III measures chest deflection by a deflection sensor located near the third rib of the test dummy. Tests conducted on the Hybrid III by NHTSA's Vehicle Research and Test Center have shown that the deflection sensor underestimates chest displacement when a load is applied to a small area away from the deflection sensor. (The test report is filed in Docket No. 74-14, General Reference, Entry 606.)

In a crash, when an occupant is not restrained by a system which provides centralized, uniform loading to a large area, such as an air bag system, the thorax deflection sensor can underestimate the actual chest compression. Thus, in a belt-restrained test dummy, the deflection sensor may read two-inches of deflection, but the actual deflection caused by the off-center loading of a belt near the bottom of the ribcage may be greater than two inches of deflection. Likewise, test dummies in passive interior cars may receive substantial off-center and concentrated loadings. For example, the agency has conducted sled tests simulating 30 mile per hour frontal barrier impacts in which unrestrained test dummies struck the steering column, as they would do in a passive interior equipped car. Measurements of the pre- and post-impact dimensions of the steering wheel rim showed that there was substantial non-symmetrical steering wheel deformation, even though these were frontal impacts. (See, e.g.,

"Frontal Occupant Sled Simulation Correlation, 1983 Chevrolet Celebrity Sled Buck," Publication No. DOT HS 806 728, February 1985.) The expected off-center chest loadings in belt and passive interior systems provide a further basis for applying a two-inch deflection limit for those systems to assure they provide protection comparable to that provided by symmetrical systems.

Use of Acceleration Limits for Air Bag Systems

Two commenters raised questions about the use of an acceleration-based criterion for vehicles which use a combined air bag and lap/shoulder belt system. Mercedes-Benz said that acceleration-based criteria are not appropriate for systems that reduce the deflection of the ribs but increase chest acceleration values. Ford also questioned the use of acceleration-based criteria. Ford said that its tests and testing done by Mercedes-Benz have shown that using an air bag in combination with a lap/shoulder belt can result in increased chest acceleration readings. Ford said it knew of no data to indicate that combined air bag-lap/shoulder belt system loads are more injurious than shoulder belt loads alone. Ford recommended that manufacturers have the option of using either the chest acceleration or chest deflection criterion until use of the Hybrid III is mandatory.

As discussed previously, acceleration and deflection represent two separate types of injury mechanisms. Therefore, the agency believes that it is important to test for both criteria. Although the tests by Mercedes-Benz and Ford show higher chest accelerations, the tests also show that it is possible to develop air bag and lap/shoulder belt systems and meet both criteria. Therefore, the agency is retaining the use of the acceleration-based criterion.

Use of Additional Sensors

Mercedes-Benz said the deflection measuring instrumentation of the Hybrid III cannot adequately measure the interaction between the chest and a variety of vehicle components. Mercedes-Benz said that it is necessary to use either additional deflection sensors or strain gauges. Renault/Peugeot recommended that the agency account for the difference between symmetrical systems and asymmetrical systems by relocating the deflection sensor.

The agency recognizes that the use of additional sensors could be beneficial in the Hybrid III to measure chest deflection. However, such technology would require considerable further development before it could be used for compliance purposes. NHTSA believes that, given the current level of technology, use of a single sensor is sufficient for the assessment of deflection-caused injuries in frontal impacts.

Femurs

The April 1985 notice proposed to apply the femur injury reduction criterion used with the Part 572 test dummy to the Hybrid III. That criterion limits the femur loads to 2250 pounds to reduce the possibility of femur fractures. No commenter objected to the proposed femur limit and it is accordingly adopted.

Ford and Toyota questioned the need to conduct three pendulum impacts for the knee. They said that using one pendulum impact with the largest mass impactor (11 pounds) was sufficient. GM has informed the agency that the lower mass pendulum impactors were used primarily for the development of an appropriate knee design. Now that the knee design is settled and controlled by the technical drawings, the tests with the low mass impactors are not needed. Accordingly, the agency is adopting the suggestion from Ford and Toyota to reduce the number of knee calibration tests and will require only the use of the 11-pound pendulum impactor.

Hybrid III Positioning Procedure

The April notice proposed new positioning procedures for the Hybrid III, primarily because the curved lumbar spine of that test dummy requires a different positioning technique than those for the Part 572. Based on its testing experience, NHTSA proposed adopting a slightly different version of the positioning procedure used by GM. The difference was the proposed use of the Hybrid III, rather than the SAE J826 H-point machine, with slightly modified leg segments, to determine the H-point of the seat.

GM urged the agency to adopt its dummy positioning procedure. GM said that users can more consistently position the test dummy's H-point using the SAE H-point machine rather than using the Hybrid III. Ford, while explaining that it had insufficient experience with the Hybrid III to develop data on positioning procedures, also urged the agency to adopt GM's positioning procedure. Ford said that since GM has developed its repeatability data on the Hybrid III using its positioning procedure, the agency should use it as well. Ford also said that the use of GM's method to position the test dummy relative to the H-point should reduce variability.

Based on a new series of dummy positioning tests done by the agency's Vehicle Research and Test Center (VRTC), NHTSA agrees that use of the SAE H-point machine is the most consistent method to position the dummy's H-point on the vehicle seat.

Accordingly, the agency is adopting the use of the H-point machine.

In the new test series, VRTC also evaluated a revised method for positioning the Hybrid III test dummy. The testing was done after the results of a joint NHTSA-SAE test series conducted in November 1985 showed that the positioning procedure used for the current Part 572 test dummy and the one proposed in the April 1985 notice for the Hybrid III does not satisfactorily work in all cars. (See Docket 74-14, Notice 39, Entry 39.) The positioning problems are principally due to the curved lumbar spine of the Hybrid III test dummy. In its tests, VRTC positioned the Hybrid III by using the SAE H-point machine and a specification detailing the final position of the Hybrid III body segments prior to the crash test. The test results showed that the H-point of the test dummy could be consistently positioned but that the vertical location of the Hybrid III H-point is 1/4 inch below the SAE H-point machine on average. Based on these results, the agency is adopting the new positioning specification for the Hybrid III which requires the H-point of the dummy to be within a specified zone centered 1/4 inch below the H-point location of the SAE H-point machine.

GM also urged the agency to make another slight change in the test procedures. GM said that when it settles the test dummy in the seat it uses a thin sheet of plastic behind the dummy to reduce the friction between the fabric of the seat back and the dummy. The plastic is removed after the dummy has been positioned. GM said this technique allows the dummy to be more repeatably positioned. The agency agrees that use of the plastic sheet can reduce friction between the test dummy and the seat. However, the use of the plastic can also create problems, such as dislocating the test dummy during removal of the plastic. Since the agency has successfully conducted its positioning tests without using a sheet of plastic, the agency does not believe there is a need to require its use.

Ford noted that the test procedure calls for testing vertically adjustable seats in their lowest position. It said such a requirement was reasonable for vertically adjustable seats that could not be adjusted higher than seats that are not vertically adjustable. However, Ford said that new power seats can be adjusted to positions above and below the manually adjustable seat position. It said that testing power seats at a different position would increase testing variability. Ford recommended adjusting vertically adjustable seats so that the dummy's hip point is as close as possible to the manufacturer's design H-point with the seat at the design mid-point of its travel.

The agency recognizes that the seat adjustment issue raised by Ford may lead to test variability. However, the agency does not have any data on the effect of Ford's suggested solution on the design of other manufacturer's power seats. The agency will solicit comments on Ford's proposal in the NPRM addressing additional Hybrid III injury criteria.

Volvo said that the lumbar supports of its seats influence the positioning of the Hybrid III. It requested that the test procedure specify that adjustable lumbar supports should be positioned in their rearmost position. Ford made a similar request. GM, however, indicated that it has not had any problems positioning the Hybrid III in seats with lumbar supports. To reduce positioning problems resulting from the lumbar supports in some vehicles, the agency is adopting Ford's and Volvo's suggestion.

Test Data Analysis

The Chairman of the Society of Automotive Engineers Safety Test Instrumentation Committee noted that the agency proposed to reference an earlier version of the SAE Recommended Practice on Instrumentation (SAE J211a, 1971). He suggested that the agency reference the most recent version (SAE J211, 1980), saying that better data correlation between different testing organizations would result. The agency agrees with SAE and is adopting the SAE J211, 1980 version of the instrumentation Recommended Practice.

Ford and GM recommended that the figures 25 and 26, which proposed a standardized coordinate system for major body segments of the test dummy, be revised to reflect the latest industry practice on coordinate signs. Since those revisions will help ensure uniformity in data analysis by different test facilities, the agency is making the changes for the test measurements adopted in this rulemaking.

Both GM and Ford also recommended changes in the filter used to process electronically measured crash data. GM suggested that a class 180 filter be used for the neck force transducer rather than the proposed class 60 filter. Ford recommended the use of a class 1,000 filter, which is the filter used for the head accelerometer.

NHTSA has conducted all of the testing used to develop the calibration test requirement for the neck using a class 60 filter. The agency does not have any data showing the effects of using either the class 180 filter proposed by GM or the class 1,000 filter proposed by Ford. Therefore the agency has adopted

the use of a class 60 filter for the neck transducer during the calibration test. The agency also used a class 60 filter for the accelerometer mounted on the neck pendulum and is therefore adopting the use of that filter to ensure uniformity in measuring pendulum acceleration.

Optional and Mandatory Use of Hybrid III

AMC, Chrysler, Ford, Jaguar and Subaru all urged the agency to defer a decision on permitting the optional use of the Hybrid III test dummy until manufacturers have had more experience with using that test dummy. AMC said it has essentially no experience with the Hybrid III and urged the agency to postpone a decision on allowing the optional use of that test dummy. AMC said this would give small manufacturers time to gain experience with the Hybrid III.

Chrysler also said that it has no experience with the Hybrid III test dummy and would need to conduct two years of testing to be able to develop sufficient information to address the issues raised in the notice. Chrysler said that it was currently developing its 1991 and 1992 models and has no data from Hybrid III test dummies on which to base its design decisions. It said that allowing the optional use of the Hybrid III before that time would give a competitive advantage to manufacturers with more experience with the test device and suggested indefinitely postponing the mandatory effective date.

Ford said that the effective date proposed for optional use of the Hybrid III should be deferred to allow time to resolve the problems Ford raised in its comments and to allow manufacturers time to acquire Hybrid III test dummies. It suggested deferring the proposed optional use until at least September 1, 1989. Ford also recommended that the mandatory use be deferred. Jaguar also said it has not had experience with the Hybrid III and asked that manufacturers have until September 1, 1987, to accumulate information on the performance of the test dummy. Subaru said that it has exclusively used the Part 572 test dummy and does not have any experience with the Hybrid III. It asked the agency to provide time for all manufacturers to gain experience with the Hybrid III, which in its case would be two years, before allowing the Hybrid III as an alternative.

A number of manufacturers, such as GM, Honda, Mercedes-Benz, Volkswagen, and Volvo, that supported optional use of the Hybrid III, urged the agency not to mandate its use at this time. GM asked the agency to permit the immediate optional use of the Hybrid III, but urged NHTSA to provide more time for all interested parties to become familiar with the test dummy before mandating its use. Honda said that while it supported optional use, it was just beginning to assess the performance of the Hybrid III and needed more time before the use of the Hybrid III is mandated. Mercedes-Benz also supported the use of the Hybrid III as an alternative test device because of its capacity to measure more types of injuries and because of its improved biofidelity for the neck and thorax. However, Mercedes recommended against mandatory use until issues concerning the Hybrid III's use in side impact, the biofidelity of its leg, durability and chest deflection measurements are resolved. Nissan opposed the mandatory us of the Hybrid III saying there is a need to further investigate the differences between the Hybrid III and the Part 572. Toyota said that it was premature to set a mandatory effective date until the test procedure and injury criteria questions are resolved. Volkswagen supported the adoption of the Hybrid III as an alternative test device, but it opposed mandating its use. Volvo supported the optional use of the Hybrid III. It noted that since NHTSA is developing an advanced test dummy, there might not be a need to require the use of the Hybrid III in the interim.

The agency recognizes that manufacturers are concerned about obtaining the Hybrid III test dummy and gaining experience with its use prior to the proposed September 1, 1991, date for mandatory use of that test dummy. However, information provided by the manufacturers of the Hybrid III shows that it will take no longer than approximately one year to supply all manufacturers with sufficient quantities of Hybrid III's. This means that manufacturers will have, at a minimum, more than four years to gain experience in using the Hybrid III. In addition, to assist manufacturers in becoming familiar with the Hybrid III, NHTSA has been placing in the rulemaking docket complete information on the agency's research programs using the Hybrid III test dummy in crash and calibration tests. Since manufacturers will have sufficient time to obtain and gain experience with the Hybrid III by September 1, 1991, the agency has decided to mandate use of the Hybrid III as of that date.

As discussed earlier in this notice, the evidence shows that the Hybrid III is more human-like in its responses to impacts than the existing Part 572 test dummy. In addition, the Hybrid III has the capability to measure far more potential injuries than the current test dummy. The agency is taking advantage of that capability by adopting a limitation on chest deflection which will enable NHTSA to measure a

significant source of injury that cannot be measured on the current test dummy. The combination of the better biofidelity and increased injury-measuring capability available with the Hybrid III will enhance vehicle safety.

Adoption of the Hybrid III will not give a competitive advantage to GM, as claimed by some of the commenters, such as Chrysler and Ford. As the developer of the Hybrid III, GM obviously has had more experience with that test dummy than other manufacturers. However, as discussed above, the agency has provided sufficient leadtime to allow all manufacturers to develop sufficient experience with the Hybrid III test dummy. In addition, as discussed in the equivalency section of this notice, there are no data to suggest that it will be easier for GM or other manufacturers to meet the performance requirements of Standard No. 208 with the Hybrid III. Thus GM and other manufacturers using Hybrid III during the phase-in period will not have a competitive advantage over manufacturers using the existing Part 572 test dummy.

Finally, in its comments GM suggested that the agency consider providing manufacturers with an incentive to use the Hybrid III test dummy. GM said that the agency should consider providing manufacturers with extra vehicle credits during the automatic restraint phase-in period for using the Hybrid III. The agency does not believe it is necessary to provide any additional incentive to use the Hybrid III. The mandatory effective date for use of the Hybrid III provides sufficient incentive, since manufacturers will want to begin using the Hybrid III as soon as possible to gain experience with the test dummy before that date.

Optional use of the Hybrid III may begin October 23, 1986. The agency is setting an effective date of less than 180 days to facilitate the efforts of those manufacturers wishing to use the Hybrid III in certifying compliance with the automatic restraint requirements.

Use of Non-instrumented Test Dummies

Ford raised a question about whether the Hybrid III may or must be used for the non-crash performance requirements of Standard No. 208, such as the comfort and convenience requirements of S7.4.3, 7.4.4, and 7.4.5 of the standard. Ford said that manufacturers should be given the option of using either the Part 572 or Hybrid III test dummy to meet the comfort and convenience requirements. The agency agrees that until September 1, 1991, manufacturers should have the option of using either the Part 572 or Hybrid III test dummy. However, since it is important the crash performance requirements and comfort and convenience requirements be linked together through the use of a single test dummy to measure a vehicle's ability to meet both sets of requirements. Therefore, beginning on September 1, 1991, use of the Hybrid III will be mandatory in determining a vehicle's compliance with any of the requirements of Standard No. 208.

In addition, Ford asked the agency to clarify whether manufacturers can continue to use Part 572 test dummies in the crash tests for Standard Nos. 212, 219, and 301, which only use non-instrumented test dummies to simulate the weight of an occupant. Ford said that the small weight difference and the small difference in seated posture between the two test dummies should have no effect on the results of the testing for Standard Nos. 212, 219, and 301. The agency agrees that use of either test dummy should not affect the test results for those standards. Thus, even after the September 1, 1991, effective date for use of the Hybrid III in the crash and non-crash testing required by Standard No. 208, manufacturers can continue to use, at their option, either the Part 572 or the Hybrid III test dummy in tests conducted in accordance with Standard Nos. 212, 219, and 301.

Economic and Other Impacts

NHTSA has examined the impact of this rulemaking action and determined that it is not major within the meaning of Executive Order 12291 or significant within the meaning of the Department of Transportation's regulatory policies and procedures. The agency has also determined that the economic and other impacts of this rulemaking action are not significant. A final regulatory evaluation describing those effects has been placed in the docket.

In preparing the regulatory evaluation, the agency has considered the comments from several manufacturers that the agency had underestimated the costs associated with using the Hybrid III. Ford said that the cost estimates contained in the April 1985 notice did not take into account the need to conduct sled tests during development work. Ford said that for 1985, it estimated it will conduct 500 sled tests requiring 1000 test dummy applications. Ford also said that NHTSA's estimate of the test dummy inventory needed by a manufacturer is low. It said that it currently has an inventory of 31 Part 572 test dummies and would expect to need a similar inventory of Hybrid III's. In addition, Ford said that NHTSA's incremental cost estimate of $3,000 per test dummy was low. It said that the cost for monitoring the extra data generated by the Hybrid III is $2,700. Ford said that it also would have to incur costs due to upgrading its data acquisition and data processing equipment.

GM said that NHTSA's estimate of a 30-test useful life for the test dummy substantially underestimates its actual useful life, assuming the test dummy is repaired periodically. It said that some of its dummies have been used in more than 150 tests. GM also said that the agency's assumption that a large manufacturer conducts testing requiring approximately 600 dummy applications each year underestimates the actual number of tests conducted. In 1984, GM said it conducted sled and barrier tests requiring 1179 dummy applications. GM said that the two underestimates, in effect, cancel each other out, since the dummies are usable for at least five times as many tests, but they are used four times as often.

Mitsubishi said that its incremental cost per vehicle is $7 rather than 40 cent as estimated by the agency. Mitsubishi explained the reason for this difference is that the price of an imported Hybrid III is approximately two times the agency estimate and its annual production is about one-tenth of the amount used in the agency estimate. Volvo also said the agency had underestimated the incremental cost per vehicle. Volvo said it conducts approximately 500–600 test dummy applications per year in sled and crash testing, making the incremental cost in the range of $15–18 per vehicle based on its export volume to the United States.

NHTSA has re-examined the costs associated with the Hybrid III test dummy. The basic Hybrid III dummy with the instrumentation required by this final rule costs $35,000 or approximately $16,000 more than the existing 572 test dummy. Assuming a useful life for the test dummy of 150 tests, the total estimated incremental capital cost is approximately $107 per dummy test.

To determine the incremental capital cost per test, the agency had to estimate the useful life of the Hybrid III. Based on NHTSA's test experience, the durability of the existing Part 572 test dummy and the Hybrid III test dummy is essentially identical with the exception of the Hybrid III ribs. Because the Hybrid III dummy chest was developed to simulate human chest deflection, the ribs had to be designed with much more precision to reflect human impact response. This redesign uses less metal and consequently they are more susceptible to damage during testing than the Part 572 dummy.

As discussed previously, GM estimates that the Hybrid III ribs can be used in severe unrestrained testing approximately 17 times before the ribs or the damping material needs replacement. In addition, GM's experience shows that the Hybrid III can withstand as many as 150 test applications as long as occasional repairs are made. Ford reported at the previously cited MVMA meeting that one of its belt-restrained Hybrid III test dummies underwent 35 crash tests without any degradation. Clearly, the estimated useful life of the test dummy is highly dependent on the type of testing, restrained or unrestrained, it is used for. Based on its own test experience and the experience of Ford and GM cited above, the agency has decided to use 30 applications as a conservative estimate of the useful life of the ribs. Assuming a life of 30 tests before a set of ribs must be replaced at a cost of approximately $2,000, the incremental per test cost is approximately $70.

The calibration tests for the Hybrid III test dummy have been simplified from the original specification proposed in the April 1985 notice. The Transportation Research Center of Ohio, which does calibration testing of the Hybrid III for the agency, vehicle manufacturers and others estimates the cost of the revised calibration tests is $1528. This is $167 less than the calibration cost for the existing Part 572 test dummy.

Numerous unknown variables will contribute to the manufacturers' operating expense, such as the cost of new or modified test facilities or equipment to maintain the more stringent temperature range of 69° F to 72° F for test dummies, and capital expenditures for lab calibration equipment, signal conditioning equipment, data processing techniques and capabilities, and additional personnel. Obviously, any incremental cost for a particular manufacturer to certify compliance with the automatic restraint requirements of Standard No. 208 will also depend on the extent and nature of its current test facilities and the size of its developmental and new vehicle test programs.

In addition to the costs discussed above, Peugeot raised the issue of a manufacturer's costs increasing because the proposed number of injury measurements made on the Hybrid III will increase the number of tests that must be repeated because of lost data. Since the agency is only adding one additional measurement, chest deflection, for the Hybrid III the number of tests that will have to be repeated due to lost data should not be substantially greater for the Hybrid III than for the Part 572.

Effective Date

NHTSA has determined that it is in the public interest to make the optional use of the Hybrid III test dummy effective in 90 days. This will allow manufacturers time to order the new test dummy to use in their new vehicle development work. Mandatory use of the Hybrid III does not begin until September 1, 1991.

In consideration of the foregoing, Part 572, *Anthropomorphic Test Dummies*, and Part 571.208, *Occupant Crash Protection*, of Title 49 of the Code of Federal Regulations is amended as follows:

Part 572–[AMENDED]

1. The authority citation for Part 572 is amended to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, and 1407; delegation of authority at 49 CFR 1.50.

2. A new Subpart E is added to Part 572 to read as follows:

Subpart E—Hybrid III Test Dummy

§ 572.30 *Incorporated materials*

§ 572.31 *General description*

§ 572.32 *Head*

§ 572.33 *Neck*

§ 572.34 *Thorax*

§ 572.35 *Limbs*

§ 572.36 *Test conditions and instrumentation*

§ 572.30 *Incorporated Materials*

(a) The drawings and specifications referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader, the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the Code of Federal Regulations.

(b) The materials incorporated by reference are available for examination in the general reference section of Docket 74-14, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street, S.W., Washington, DC 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, DC 20005 ((202) 628-6667). The drawings and specifications are also on file in the reference library of the Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

§ 572.31 *General description*

(a) The Hybrid III 50th percentile size dummy consists of components and assemblies specified in the Anthropomorphic Test Dummy drawing and specifications package which consists of the following six items:

(1) The Anthropomorphic Test Dummy Parts List, dated July 15, 1986, and containing 13 pages, and a Parts List Index, dated April 26, 1986, containing 6 pages,

(2) A listing of Optional Hybrid III Dummy Transducers, dated April 22, 1986, containing 4 pages,

(3) A General Motors Drawing Package identified by GM drawing No. 78051-218, revision P and subordinate drawings,

(4) Disassembly, Inspection, Assembly and Limbs Adjustment Procedures for the Hybrid III dummy, dated July 15, 1986,

(5) Sign Convention for the signal outputs of Hybrid II dummy transducers, dated July 15, 1986,

(6) Exterior Dimensions of the Hybrid III dummy, dated July 15, 1986.

(b) The dummy is made up of the following component assemblies:

Drawing Number	*Revision*
78051-61 Head Assembly—Complete—	(T)
78051-90 Neck Assembly—Complete—	(A)
78051-89 Upper Torso Assembly—Complete—	(I)
78051-70 Lower Torso Assembly—Without Pelvic Instrumentation Assembly, Drawing No. 78051-59	(C)
86-5001-001 Leg Assembly—Complete (LH)—	
86-5001-002 Leg Assembly—Complete (RH)—	
78051-123 Arm Assembly—Complete (LH)—	(D)
78051-124 Arm Assembly—Complete (RH)—	(D)

(c) Any specifications and requirements set forth in this part supercede those contained in General Motors Drawing No. 78051-218, revision P.

(d) Adjacent segments are joined in a manner such that throughout the range of motion and also under crash-impact conditions, there is no contact between metallic elements except for contacts that exist under static conditions.

(e) The weights, inertial properties and centers of gravity location of component assemblies shall conform to those listed in drawing 78051-338, revision S.

(f) The structural properties of the dummy are such that the dummy conforms to this part in every respect both before and after being used in vehicle test specified in Standard No. 208 of this Chapter (§ 571.208).

§ 572.32 *Head*

(a) The head consists of the assembly shown in the drawing 78051-61, revision T, and shall conform to each of the drawings subtended therein.

(b) When the head (drawing 78051-61, revision T) with neck transducer structural replacement (drawing 78051-383, revision F) is dropped from a height of 14.8 inches in accordance with paragraph (c) of this section, the peak resultant accelerations at the location of the accelerometers mounted in the head in accordance with 572.36(c) shall not be less than 225g, and not more than 275g. The acceleration/time curve for the test shall be unimodal to the extent that oscillations occurring after the main acceleration pulse are less than ten percent (zero to peak) of the main pulse. The lateral acceleration vector shall not exceed 15g (zero to peak).

(c) *Test Procedure.* (1) Soak the head assembly in a test environment at any temperature between 66° F to 78° F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(2) Clean the head's skin surface and the surface of the impact plate with 1,1,1 Trichlorethane or equivalent.

(3) Suspend the head, as shown in Figure 19, so that the lowest point on the forehead is 0.5 inches below the lowest point on the dummy's nose when the midsagittal plane is vertical.

(4) Drop the head from the specified height by means that ensure instant release onto a rigidly supported flat horizontal steel plate, which is 2 inches thick and 2 feet square. The plate shall have a clean, dry surface and any microfinish of not less than 8 microinches (rms) and not more than 80 microinches (rms).

(5) Allow at least 2 hours between successive tests on the same head.

§ 572.33 *Neck*

(a) The neck consists of the assembly shown in drawing 78051-90, revision A and conforms to each of the drawings subtended therein.

(b) When the neck and head assembly (consisting of the parts 78051-61, revision T; -84; -90, revision A; -96; -98; -303, revision E; -305; -306; -307, revision X, which has a neck transducer (drawing 83-5001-008) installed in conformance with 572.36(d), is tested in accordance with paragraph (c) of this section, it shall have the following characteristics:

(1) *Flexion* (i) Plane D, referenced in Figure 20, shall rotate, between 64 degrees and 78 degrees, which shall occur between 57 milliseconds (ms) and 64 ms from time zero. In first rebound, the rotation of plane D shall cross 0 degree between 113 ms and 128 ms.

(ii) The moment measured by the neck transducer (drawing 83-5001-008) about the occipital condyles, referenced in Figure 20, shall be calculated by the following formula: Moment (lbs-ft) = $M_y + 0.02875 \times F_x$ where M_y is the moment measured in lbs-ft by the moment sensor of the neck transducer and F_x is the force measure measured in lbs by the x axis force sensor of the neck transducer. The moment shall have a maximum value between 65 lbs-ft and 80 lbs-ft occurring between 47 ms and 58 ms, and the positive moment shall decay for the first time to 0 lb-ft between 97 ms and 107 ms.

(2) *Extension* (i) Plane D, referenced in Figure 21, shall rotate between 81 degrees and 106 degrees, which shall occur between 72 and 82 ms from time zero. In first rebound, the rotation of plane D shall cross 0 degree between 147 and 174 ms.

(ii) The moment measured by the neck transducer (drawing 83-5001-008) about the occipital condyles, referenced in Figure 21, shall be calculated by the following formula: Moment (lbs-ft) = $M_y + 0.02875 \times F_x$ where M_y is the moment measured in lbs-ft by the moment sensor of the neck transducer and F_x is the force measure measured in lbs by the x axis force sensor of the neck transducer. The moment shall have a minimum value between −39 lbs-ft and −59 lbs-ft, which shall occur between 65 ms and 79 ms., and the negative moment shall decay for the first time to 0 lb-ft between 120 ms and 148 ms.

(3) Time zero is defined as the time of contact between the pendulum striker plate and the aluminum honeycomb material.

(c) *Test Procedure.* (1) Soak the test material in a test environment at any temperature between 69 degrees F to 72 degrees F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(2) Torque the jamnut (78051-64) on the neck cable (78051-301, revision E) to 1.0 lbs-ft ± .2 lbs-ft.

(3) Mount the head-neck assembly, defined in paragraph (b) of this section, on a rigid pendulum as shown in Figure 22 so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal axis.

(4) Release the pendulum and allow it to fall freely from a height such that the tangential velocity at the pendulum accelerometer centerline at the instance of contact with the honeycomb is 23.0 ft/sec ± 0.4 ft/sec. for flexion testing and 19.9 ft/sec ± 0.4 ft/sec. for extension testing. The pendulum deceleration vs. time pulse for flexion testing shall

conform to the characteristics shown in Table A and the decaying deceleration-time curve shall first cross 5g between 34 ms and 42 ms. The pendulum deceleration vs. time pulse for extension testing shall conform to the characteristics shown in Table B and the decaying deceleration-time curve shall cross 5g between 38 ms and 46 ms.

Table A
Flexion Pendulum Deceleration vs. Time Pulse

Time (ms)	*Flexion deceleration level (g)*
10	22.50-27.50
20	17.60-22.60
30	12.50-18.50
Any other time above 30 ms	29 maximum

Table B
Extension Pendulum Deceleration vs. Time Pulse

Time (ms)	*Extension deceleration level (g)*
10	17.20-21.20
20	14.00-19.00
30	11.00-16.00
Any other time above 30 ms	22 maximum

(5) Allow the neck to flex without impact of the head or neck with any object during the test.

§ 572.34 *Thorax*

(a) The thorax consists of the upper torso assembly in drawing 78051-89, revision I and shall conform to each of the drawings subtended therein.

(b) When impacted by a test probe conforming to S572.36(a) at 22 fps ± .40 fps in accordance with paragraph (c) of this section, the thorax of a complete dummy assembly (78051-218, revision P) with left and right shoes (78051-294 and -295) removed, shall resist with the force measured by the test probe from time zero of 1162.5 pounds ± 82.5 pounds and shall have a sternum displacement measured relative to spine of 2.68 inches ± .18 inches. The internal hysteresis in each impact shall be more than 69% but less than 85%. The force measured is the product of pendulum mass and deceleration. Time zero is defined as the time of first contact between the upper thorax and pendulum face.

(c) *Test procedure.* (1) Soak the test dummy in an environment with a relative humidity from 10% to 70% until the temperature of the ribs of the test dummy have stabilized at a temperature between 69° F and 72° F.

(2) Seat the dummy without back and arm supports on a surface as shown in Figure 23.

(3) Place the longitudinal centerline of the test probe so that it is .5 ± .04 in. below the horizontal centerline of the No. 3 Rib (reference drawing number 79051-64, revision A-M) as shown in Figure 23.

(4) Align the test probe specified in S572.36(a) so that at impact its longitudinal centerline coincides within .5 degree of a horizontal line in the dummy's midsagittal plane.

(5) Impact the thorax with the test probe so that the longitudinal centerline of the test probe falls within 2 degrees of a horizontal line in the dummy midsagittal plane at the moment of impact.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

(7) Measure the horizontal deflection of the sternum relative to the thoracic spine along the line established by the longitudinal centerline of the probe at the moment of impact, using a potentiometer (ref. drawing 78051-317, revision A) mounted inside the sternum as shown in drawing 78051-89, revision I.

(8) Measure hysteresis by determining the ratio of the area between the loading and unloading portions of the force deflection curve to the area under the loading portion of the curve.

§572.35 *Limbs*

(a) The limbs consist of the following assemblies: leg assemblies 86-5001-001 and -002 and arm assemblies 78051-123, revision D, and -124, revision D, and shall conform to the drawings subtended therein.

(b) When each knee of the leg assemblies is impacted by the pendulum defined in S572.36(b) in accordance with paragraph (c) of this section at 6.9 ft/sec ± .10 ft/sec., the peak knee impact force, which is a product of pendulum mass and acceleration, shall have a minimum value of not less than 996 pounds and a maximum value of not greater than 1566 pounds.

(c) *Test Procedure.* (1) The test material consists of leg assemblies (86-5001-001) left and (-002) right with upper leg assemblies (78051-46) left and

(78051-47) right removed. The load cell simulator (78051-319, revision A) is used to secure the knee cap assemblies (79051-16, revision B) as shown in Figure 24.

(2) Soak the test material in a test environment at any temperature between 66° F to 78° F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(3) Mount the test material with the leg assembly secured through the load cell simulator to a rigid surface as shown in Figure 24. No contact is permitted between the foot and any other exterior surfaces.

(4) Place the longitudinal centerline of the test probe so that at contact with the knee it is colinear within 2 degrees with the longitudinal centerline of the femur load cell simulator.

(5) Guide the pendulum so that there is no significant lateral, vertical or rotational movement at time zero.

(6) Impact the knee with the test probe so that the longitudinal centerline of the test probe at the instant of impact falls within .5 degrees of a horizontal line parallel to the femur load cell simulator at time zero.

(7) Time zero is defined as the time of contact between the test probe and the knee.

§ 572.36 *Test conditions and instrumentation*

(a) The test probe used for thoracic impact tests is a 6 inch diameter cylinder that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.5 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(b) The test probe used for the knee impact tests is a 3 inch diameter cylinder that weighs 11 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.2 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(c) Head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing 78051-136, revision A or its equivalent and be mounted in the head as shown in drawing 78051-61, revision T, and in the assembly shown in drawing 78051-218, revision D.

(d) The neck transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 83-5001-008 or its equivalent and be mounted for testing as shown in drawing 79051-63, revision W, and in the assembly shown in drawing 78051-218, revision P.

(e) The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing 78051-136, revision A or its equivalent and be mounted as shown with adaptor assembly 78051-116, revision D, for assembly into 78051-218, revision L.

(f) The chest deflection transducer shall have the dimensions and response characteristics specified in drawing 78051-342, revision A or equivalent, and be mounted in the chest deflection transducer assembly 87051-317, revision A, for assembly into 78051-218, revision L.

(g) The thorax and knee impactor accelerometers shall have the dimensions and characteristics of Endevco Model 7231c or equivalent. Each accelerometer shall be mounted with its sensitive axis colinear with the pendulum's longitudinal centerline.

(h) The femur load cell shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 78051-265 or its equivalent and be mounted in assemblies 78051-46 and -47 for assembly into 78051-218, revision L.

(i) The outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified by this part are recorded in individual data channels that conform to the requirements of SAE Recommended Practice J211, JUNE 1980, "Instrumentation for Impact Tests," with channel classes as follows:

(1) Head acceleration—Class 1000
(2) Neck force—Class 60
(3) Neck pendulum acceleration—Class 60
(4) Thorax and thorax pendulum acceleration—Class 180
(5) Thorax deflection—Class 180
(6) Knee pendulum acceleration—Class 600
(7) Femur force—Class 600

(j) Coordinate signs for instrumentation polarity conform to the sign convention shown in the document incorporated by § 572.31(a)(5).

(k) The mountings for sensing devices shall have no resonance frequency within range of 3 times the frequency range of the applicable channel class.

(l) Limb joints are set at lg, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment shall not exceed 2g throughout the range of limb motion.

(m) Performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise noted.

(n) Surfaces of dummy components are not painted except as specified in this part or in drawings subtended by this part. PART 571 [Amended]

2. The authority citation for Part 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

3. Section S5 of Standard No. 208 (49 CFR 571.208) is amended by revising S5.1 to read as follows:

§ 571.208 [Amended]

S5. *Occupant crash protection requirements.*

S5.1 Vehicles subject to S5.1 and manufactured before September 1, 1991, shall comply with either, at the manufacturer's option, 5.1(a) or (b). Vehicles subject to S5.1 and manufactured on or after September 1, 1991, shall comply with 5.1(b).

(a) Impact a vehicle traveling longitudinally forward at any speed, up to and including 30 mph, into a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle under the applicable conditions of S8. The test dummy specified in S8.1.8.1 placed at each front outboard designated seating position shall meet the injury criteria of S6.1.1, 6.1.2, 6.1.3, and 6.1.4.

(b) Impact a vehicle traveling longitudinally forward at any speed, up to and including 30 mph, into a fixed collision barrier that is perpendicular to the line of travel of the vehicle, or at any angle up to 30 degrees in either direction from the perpendicular to the line of travel of the vehicle, under the applicable conditions of S8. The test dummy specified in S8.1.8.2 placed at each front outboard designated seating position shall meet the injury criteria of S6.2.1, 6.2.2, 6.2.3, 6.2.4, and 6.2.5.

3. Section S5.2 of Standard No. 208 is revised to read as follows:

S5.2 Lateral moving barrier crash.

S5.2.1 Vehicles subject to S5.2 and manufactured before September 1, 1991, shall comply with either, at the manufacturer's option, 5.2.1(a) or (b). Vehicles subject to S5.2 and manufactured on or after September 1, 1991, shall comply with 5.2.1(b).

(a) Impact a vehicle laterally on either side by a barrier moving at 20 mph under the applicable conditions of S8. The test dummy specified in S8.1.8.1 placed at the front outboard designated seating position adjacent to the impacted side shall meet the injury criteria of S6.1.2 and S6.1.3.

(b) When the vehicle is impacted laterally under the applicable conditions of S8, on either side by a barrier moving at 20 mph, with a test device specified in S8.1.8.2, which is seated at the front outboard designated seating position adjacent to the impacted side, it shall meet the injury criteria of S6.2.2, and S6.2.3.

4. Section S5.3 of Standard No. 208 is revised to read as follows:

S5.3 *Rollover* Subject a vehicle to a rollover test under the applicable condition of S8 in either lateral direction at 30 mph with either, at the manufacturer's option, a test dummy specified in S8.1.8.1 or S8.1.8.2, placed in the front outboard designated seating position on the vehicle's lower side as mounted on the test platform. The test dummy shall meet the injury criteria of either S6.1.1 or S6.2.1.

5. Section S6 of Standard No. 208 is revised to read as follows:

S6. *Injury Criteria*

S6.1 Injury criteria for the Part 572, Subpart B, 50th percentile Male Dummy.

S6.1.1 All portions of the test dummy shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test.

S6.1.2 The resultant acceleration at the center of gravity of the head shall be such that the expression:

$$\left[\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} a\,dt\right]^{2.5} t_2 - t_1$$

shall not exceed 1,000, where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2 are any two points during the crash.

S6.1.3 The resultant acceleration at the center of gravity of the upper thorax shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S6.1.4 The compressive force transmitted axially through each upper leg shall not exceed 2250 pounds.

S6.2 *Injury criteria for the Part 572, Subpart E, Hybrid III Dummy*

S6.2.1 All portions of the test dummy shall be contained within the outer surfaces of the vehicle passenger compartment throughout the test.

S6.2.2 The resultant acceleration at the center of gravity of the head shall be such that the expression:

$$\left[\frac{1}{t_2 - t_1}\int_{t_1}^{t_2} a\,dt\right]^{2.5} t_2 - t_1$$

shall not exceed 1,000, where a is the resultant acceleration expressed as a multiple of g (the acceleration of gravity), and t_1 and t_2 are any two point during the crash.

S6.2.3 The resultant acceleration calculated from the thoracic instrumentation shown in drawing 78051-218, revision L, incorporated by reference in Part 572, Subpart E of this Chapter, shall not exceed 60g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S6.2.4 Compression deflection of the sternum relative to spine, as determined by instrumentation shown in drawing 78051-317, revision A, incorporated by reference in Part 572, Subpart E of this Chapter, shall not exceed 2 inches for loadings applied through any impact surfaces except for those systems which are gas inflated and provide distributed loading to the torso during a crash. For gas-inflated systems which provide distributive loading to the torso, the thoracic deflection shall not exceed 3 inches.

S6.2.5 The force transmitted axially through each upper leg shall not exceed 2250 pounds.

6. Section S8.1.8 of Standard No. 208 is revised to read as follows:

S8.1.8 *Anthropomorphic test dummies*

S8.1 8.1 The anthropomorphic test dummies used for evaluation of occupant protection systems manufactured pursuant to applicable portions of paragraphs S4.1.2, 4.1.3, and S4.1.4 shall conform to the requirements of Subpart B of Part 572 of this Chapter.

S8.1.8.2 Anthropomorphic test devices used for the evaluation of occupant protection systems manufactured pursuant to applicable portions of paragraphs S4.1.2, S4.1.3, and S4.1.4 shall conform to the requirements of Subpart E of Part 572 of this Chapter.

7. Section S8.1.9 of Standard No. 208 is revised to read as follows:

S8.1.9.1 Each Part 572, Subpart B, test dummy specified in S8.1.8.1 is clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the test dummy is equipped with a size 11EE shoe which meets the configuration size, sole, and heel thickness specifications of MIL-S-131192 and weighs 1.25 ± 0.2 pounds.

S8.1.9.2 Each Part 572, Subpart E, test dummy specified in S8.1.8.2 is clothed in formfitting cotton stretch garments with short sleeves and midcalf length pants specified in drawings 78051-292 and -293 incorporated by reference in Part 572, Subpart E, of this Chapter, respectively or their equivalents. A size 11EE shoe specified in drawings 78051-294 (left) and 78051-295 (right) or their equivalents is placed on each foot of the test dummy.

8. Section S8.1.13 of Standard No. 208 is revised to read as follows:

S8.1.13 *Temperature of the test dummy*

S8.1.13.1 The stabilized temperature of the test dummy specified by S8.1.8.1 is at any level between 66 degrees F and 78 degrees F.

S8.1.13.2 The stabilized temperature of the test dummy specified by S8.1.8.2 is at any level between 69 degrees F and 72 degrees F.

9. A new fourth sentence is added to section S8.1.3 to read as follows:

Adjustable lumbar supports are positioned so that the lumbar support is in its lowest adjustment position.

10. A new section S11 is added to read as follows:

S11. *Positioning Procedure for the Part 572 Subpart E Test Dummy*

Position a test dummy, conforming to Subpart E of Part 572 of this Chapter, in each front outboard seating position of a vehicle as specified in S11.1 through S11.6. Each test dummy is restrained in accordance with the applicable requirements of S4.1.2.1, 4.1.2.2 or S4.6.

S11.1 *Head.* The transverse instrumentation platform of the head shall be horizontal within ½ degree.

S11.2 *Arms*

S11.2.1 The driver's upper arms shall be adjacent to the torso with the centerlines as close to a vertical plane as possible.

S11.2.2 The passenger's upper arms shall be in contact with the seat back and the sides of torso.

S11.3 *Hands*

S11.3.1 The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centerline. The thumbs shall be over the steering wheel rim and attached with adhesive tape to provide a breakaway force of between 2 to 5 pounds.

S11.3.2 The palms of the passenger test dummy shall be in contact with outside of thigh. The little finger shall be in contact with the seat cushion.

S11.4 *Torso*

S11.4.1 In vehicles equipped with bench seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver dummy shall be vertical and parallel to the vehicle's longitudinal centerline, and pass through the center of the steering wheel rim. The midsagittal plane of the passenger dummy shall be vertical and parallel to the vehicle's longitudinal centerline and the same distance from the vehicle's longitudinal centerline as the midsagittal plane of the driver dummy.

S11.4.2 In vehicles equipped with bucket seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver and the passenger dummy shall be vertical and shall coincide with the longitudinal centerline of the bucket seat.

S11.4.3 *Lower torso*

S11.4.3.1 *H-point.* The H-point of the driver and passenger test dummies shall coincide within ½ inch in the vertical dimension and ½ inch in the horizontal dimension of a point ¼ inch below the position of the H-point determined by using the equipment and procedures specified in SAE J826 (Apr 80) except that the length of the lower leg and thigh segments of the H-point machine shall be adjusted to 16.3 and 15.8 inches, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

S11.4.3.2 *Pelvic angle.* As determined using the pelvic angle gage (GM drawing 78051-532 incorporated by reference in Part 572, Subpart E, of this chapter) which is inserted into the H-point gaging hole of the dummy, the angle measured from the horizontal on the 3 inch flat surface of the gage shall be 22½ degrees plus or minus 2½ degrees.

S11.5 *Legs.* The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches. To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. Final adjustment to accommodate placement of feet in accordance with S11.6 for various passenger compartment configurations is permitted.

S11.6 *Feet*

S11.6.1 The right foot of the driver test dummy shall rest on the undepressed accelerator with the rearmost point of the heel on the floor surface in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be positioned perpendicular to the tibia and placed as far forward as possible in the direction of the centerline of the pedal with the rearmost point of the heel resting on the floor surface. The heel of the left foot shall be placed as far forward as possible and shall rest on the floor surface. The left foot shall be positioned as flat as possible on the floor surface. The longitudinal centerline of the left foot shall be placed as parallel as possible to the longitudinal centerline of the vehicle.

S11.6.2 The heels of both feet of the passenger test dummy shall be placed as far forward as possible and shall rest on the floor surface. Both feet shall be positioned as flat as possible on the floor surface. The longitudinal centerline of the feet shall be placed as parallel as possible to the longitudinal centerline of the vehicle.

S11.7 *Test dummy positioning for latchplate access.* The reach envelopes specified in S7.4.4 are obtained by positioning a test dummy in the driver's seat or passenger's seat in its forwardmost adjustment position. Attach the lines for the inboard and outboard arms to the test dummy as described in Figure 3 of this standard. Extend each line backward and outboard to generate the compliance arcs of the outboard reach envelope of the test dummy's arms.

S11.8 *Test dummy positioning for belt contact force.* To determine compliance with S7.4.3 of this standard, position the test dummy in the vehicle in accordance with the requirements specified in S11.1 through S11.6 and under the conditions of S8.1.2 and S8.1.3. Pull the belt webbing three inches from the test dummy's chest and release until the webbing is within 1 inch of the test dummy's chest and measure the belt contact force.

S11.9 *Manual belt adjustment for dynamic testing.* With the test dummy at its designated seating position as specified by the appropriate requirements of S8.1.2, S8.1.3 and S11.1 through S11.6, place the Type 2 manual belt around the test dummy and fasten the latch. Remove all slack from the lap belt. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 2 to 4 pound tension load

to the lap belt. If the belt system is equipped with a tension-relieving device introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer for normal use in the owner's manual for the vehicle. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor.

Issued on July 21, 1986

Diane K. Steed
Administrator

51 F.R. 26688
July 25,1986

PREAMBLE TO AN AMENDMENT TO PART 572

Anthropomorphic Test Dummies

[Docket No. 74-14; Notice 54]

ACTION: Final rule; response to petitions for reconsideration.

SUMMARY: In July 1986, this agency published a final rule mandating the use of the Hybrid III test dummy in compliance testing under Standard No. 208 beginning September 1, 1991. That same rule permitted the optional use of the Hybrid III test dummy for compliance testing beginning October 23, 1986. Eleven organizations filed petitions for reconsideration of this rule.

In response to these petitions, the agency is making three significant and several other changes to the final rule published in July 1986. The first of the significant changes is the suspension of the September 1, 1991, date for mandatory use of the Hybrid III test dummy in compliance testing. The mandatory use date is being suspended because, inadvertently, insufficient time was permitted to address the technical questions that may arise through the use of this new test dummy.

The second significant change is the amendment of the thorax deflection requirement to increase the permissible deflection of the Hybrid III thorax (chest) during compliance testing from two to three inches. The thorax deflection limit is being increased because it appears that most 2-point automatic belt designs used in current vehicles would not comply with the previously established two inch thorax deflection limit. The available accident data do not show an increased risk of thorax injuries to occupants of 2-point belt systems, as compared with occupants of 3-point belt systems or air bags. On the other hand, some limited biomechanical data appear to suggest that 2-point belted occupants may suffer chest injuries more frequently than their 3-point belted or air bag restrained counterparts. These inconsistencies between the different data cannot be resolved at the present time. The agency intends to take the necessary steps to obtain sufficient data in this area to arrive at a satisfactory resolution of the inconsistencies. Given the current uncertainties, however, this rule establishes a three inch chest deflection limit for the Hybrid III test dummy. The available data for 2-point and 3-point belt systems and for air bags indicate that this three inch limit is practicable and meets the need for safety.

The third significant change is a delay until September 1, 1990, in the use of the Hybrid III dummy for compliance testing of vehicles that do not use any restraint system to provide automatic occupant protection. Such restraint systems have generally been called "passive interiors." Up to this point, the agency has established the same chest deflection limit for Hybrid III dummies restrained by safety belts and those that are unrestrained. However, the agency wants to further investigate whether it is appropriate to establish separate chest deflection limits for unrestrained and safety-belt restrained Hybrid III dummies. Additionally, the agency wants to determine if the Hybrid III dummy with a three inch chest deflection limit is equivalent to the older type of test dummy when both are unrestrained. The temporary delay in the use of the Hybrid III test dummy for certain vehicles will provide the agency with sufficient time to determine whether a chest deflection limit lower than three inches should be proposed for unrestrained Hybrid III dummies, and, if so, which lower limit should be proposed.

This notice also makes several other changes to the July 1986 rule in response to the petitions for reconsideration. These are:

1. This notice adjusts the required calibration responses for the dummy's thorax and femur. The thorax force response adjustment is necessary to reflect the characteristics of the dummy's rib cage structure when the ribs are manufactured with new rib damping material. The femur force adjustment narrows the acceptable force response range during calibration. Both of these adjustments will result in more consistently repeatable dummy impact responses during crash testing. NHTSA has made the appropriate adjustments to the drawing and specifications package for the Hybrid III dummy to reflect these changes.

2. This notice makes certain clarifying amendments to Standard No. 208 to permit the use of the Hybrid III test dummy for compliance testing with all the requirements of Standard No. 208 and to permit the use of both types of test dummies in

any Standard No. 208 testing conducted before the use of the Hybrid III becomes mandatory.

EFFECTIVE DATE: The regulatory changes made in response to the petitions for reconsideration are effective on March 17, 1988.

SUPPLEMENTARY INFORMATION:

Background

In December 1983, General Motors (GM) petitioned the agency to amend 49 CFR Part 572, *Anthropomorphic Test Dummies*, to include specifications for the Hybrid III test dummy that GM had developed. GM stated in its petition that the Hybrid III test dummy provides more meaningful information about the occupant protection potential of a vehicle than does the test dummy specified in Subpart B of Part 572. GM also argued that the Hybrid III test dummy's impact responses during a crash are more representative of human responses. Additionally, GM stated that the Hybrid III allows the assessment of more types of potential injuries, with 31 total measurements as opposed to eight measurements with the Part 572 Subpart B test dummy. GM also claimed that the repeatability and reproducibility of the Hybrid III are as good as those of the Subpart B test dummy. In support of these claims, GM submitted numerous documents to the agency.

After evaluating the petition and the supporting documents, NHTSA published a proposal on April 12, 1985 (50 FR 14602). That notice proposed to adopt the Hybrid III test dummy as an alternative to the Part 572 Subpart B test dummy for compliance testing under Standard No. 208, *Occupant Crash Protection* (49 CFR §571.208) until September 1, 1991. After that date, the agency proposed to use only the Hybrid III test dummy for compliance testing under Standard No. 208.

The agency proposed that action because it tentatively concluded that the Hybrid III test dummy appeared to represent an appreciable advance in the state-of-the-art of human simulation. NHTSA was particularly interested in the Hybrid III test dummy because of its apparently superior biofidelity and updated anthropometry, as compared with the Part 572 Subpart B test dummy. Further, because the Hybrid III test dummy has the capability of monitoring almost four times as many injury indicating parameters as the Subpart B test dummy, it can be used to measure injury producing forces, accelerations, deflections, moments, etc., for areas of the body that are not instrumented in the Subpart B test dummy. For instance, the Hybrid III test dummy has instrumentation capable of measuring injury producing forces experienced by the neck and lower legs. Although these body areas show a high incidence of serious and/or disabling injuries in crashes, the agency cannot make use of the Subpart B test dummy to evaluate the extent of the protection afforded to these body areas by vehicle safety systems. Because of these attributes of the Hybrid III test dummy, NHTSA believed that it should eventually replace the Subpart B test dummy as the tool used to evaluate the protection that vehicles afford occupants during frontal crashes.

The Final Rule

After evaluating the comments on the April 1985 proposal, NHTSA published a final rule adopting the Hybrid III test dummy on July 25, 1986 (51 FR 26688). This final rule made some adjustments to the calibration procedures proposed to be used with the Hybrid III test dummy. The calibration procedures involve a series of static and dynamic tests of the test dummy components to determine whether the responses of the dummy fall within specified ranges. These calibration procedures help ensure that the test dummy has been properly assembled and that the assembled test dummy will give repeatable and reproducible results during crash testing. (Repeatability refers to the ability of the same test dummy to produce the same results when subjected to identical tests. Reproducibility refers to the ability of one test dummy to provide the same results as another test dummy built to the same specifications.)

The preamble to the final rule also stated that the agency had concluded that the two types of test dummies were equivalent; i.e., when both test dummies were restrained by lap/shoulder belts or with air bags, only minimal differences in test results were shown by the two types of dummies. The importance of equivalence is that vehicles, which will pass or fail Standard No. 208 using one type of dummy, will achieve essentially the same result using the other dummy.

The exception to the finding of equivalence occurred for chest acceleration measurements for unrestrained Hybrid III test dummies. The chest acceleration measurements for unrestrained

Hybrid III dummies were consistently lower than the chest acceleration measurements for unrestrained Part 572 Subpart B dummies. If the two test dummies were to be equivalent, some additional measurement of injury producing forces to the chest of the Hybrid III test dummy would have to be recorded to compensate for the lower chest acceleration measurements with this test dummy. Chest injuries generally are caused by excessive loading on the chest, when the chest contacts the restraint system and possibly the steering system, if the occupant is restrained, or the steering system or other passenger compartment components, if the occupant is unrestrained. The agency concluded that a measurement of chest deflection in testing with the Hybrid III test dummy would appropriately compensate for that dummy's lower chest acceleration measurements when it was unrestrained. Therefore, the July 1986 final rule specified a limit on the amount of thorax deflection that could occur with the Hybrid III test dummy, as the means of ensuring equivalence of the two types of test dummies. See 51 FR at 26693-26694.

Having determined that a thorax deflection limit was necessary to ensure equivalence of the two types of test dummies, the obvious question was what that limit should be. The agency began by examining biomedical data on thorax deflection. Excessive chest deflection can produce rib fractures which can impair breathing and inflict serious damage to the internal organs within the perimeter of the chest structure. The agency began by examining test results to compare the measured responses of Hybrid III test dummies and the injuries induced in cadavers under identical impact conditions. Injuries induced in the cadavers were rated on the Abbreviated Injury Scale (AIS). An AIS rating of 1 is a minor injury, while an AIS of 3 is a serious injury. The rated cadaver injuries were then compared with the chest deflection experienced by a Hybrid III test dummy under identical impact conditions.

In tests using a relatively stiff air bag, which was preinflated and not vented, the cadaver sustained an average injury level of AIS 1.5 (minor to moderate), while the Hybrid III test dummy experienced a 2.7 inch chest deflection under the same conditions. NHTSA concluded that these results demonstrated that a system that symmetrically and uniformly distributes impact loads over the entire chest can produce approximately three inches of chest deflection, as measured on the Hybrid III dummy, and still adequately protect an occupant from serious injury.

However, the testing with belt restraints that did not uniformly or symmetrically spread loads over the entire chest and with other protective systems where the impact loads were highly concentrated over a relatively small area suggested that chest deflection in other portions of the chest could be significantly greater than was shown by the centrally mounted chest deflection gauge on the Hybrid III dummy. Accordingly, it appeared reasonable to establish a chest deflection limit of less than three inches to ensure that those restraint systems would provide a level of chest protection comparable to that provided by restraint systems that symmetrically spread the load over the entire chest surface. When evaluating lap/-shoulder belts in a laboratory environment, the cadavers had moderate to serious injuries (AIS of 2.6) induced under the same conditions that the Hybrid III experienced chest deflection of 1.6 inches. Additionally, some pendulum tests were conducted for GM. In these tests, blunt, concentrated loads are intended to stimulate unrestrained vehicle occupant impacts into the steering wheel or other interior components. This testing showed that the cadavers had serious chest injuries induced (average AIS of 2.8) under the same impact conditions in which the Hybrid III dummy measured 2.63 inches of chest deflection.

The available biomechanical data on this subject are based on a limited number of cadaver tests that are not large enough to make statistically significant injury projections. While the agency could not and did not rely on these limited biomechanical data *alone* to justify a decision to establish any particular limit for chest deflection, these data did suggest that a limit as low as 1.6 inches of chest deflection should be considered for the Hybrid III test dummy.

In addition to the indications from the biomechanical data that a chest deflection limit of less than three inches should be adopted for impact exposures that provide concentrated loadings over a limited area of the chest, the agency was also concerned that the Hybrid III test dummy could, in many instances, underestimate actual chest deflection. The Hybrid III measures chest deflection by a deflection sensor located near the third rib of the test dummy, on the midsternum of the dummy's chest. NHTSA testing has shown that the Hybrid III's deflection sensor underestimates chest displacement when a load is applied to an area away from the deflection sensor.

The agency recognized the limitations of the biomechanical data when it was considering what chest deflection limit should be established for

restraint systems that can provide concentrated loadings over a limited area of the chest. Given these limitations, NHTSA examined the chest deflection levels that occur with current vehicle restraint systems. To do this, NHTSA examined the crash performance of existing restraint systems in available accident files, such as National Accident Sampling System (NASS) and Fatal Accident Reporting System (FARS). These data showed that existing 2- and 3-point safety belts, when used, offer vehicle occupants a high level of safety protection, including protection against the risk of serious chest injuries. Therefore, the agency determined that the chest deflection limit could safely be set at a level that was compatible with the level of chest deflection that would be experienced in 30 mph tests with existing 2- and 3-point belt designs.

Test data available to the agency at the time of the final rule indicated that the two inch limit could be satisfied by existing designs of 3-point manual belts, 2-point automatic belts, and 3-point manual belts with air bags. For instance, the data available on 3-point manual safety belts in 30 mph frontal impacts with the Hybrid III test dummy showed chest deflections ranging from an average of 0.67 inch in NHTSA car-to-car testing to 1.89 inches in GM sled testing. For the Volkswagen 2-point automatic belts, the data showed chest deflections ranging from 0.79 inch to 1.09 inches in NHTSA testing. Bases on these data, the agency concluded that a two inch chest deflection limit was an achievable level for existing restraint system designs.

Thus, the decision to adopt a two inch chest deflection limit for restraint systems that did not generally distribute the load over the entire chest area was based on the following factors:

1. The limited biomechanical data that were available suggested that there was a safety need for a chest deflection limit at a level below three inches;

2. A chest deflection limit below three inches would compensate for the Hybrid III's tendency to underestimate chest deflection when a load is applied to a small area away from the deflection sensor; and

3. Existing 2- and 3-point belt systems could comply with a two inch chest deflection limit, based on the limited testing data available to the agency.

Petitions for Reconsideration

The agency received petitions for reconsideration of this final rule from nine different organizations. Many of the petitions for reconsideration raised issues involving the positioning of the Hybrid III dummy during compliance testing. In its November 23, 1987, final rule establishing dynamic testing requirements for light trucks and light multipurpose passenger vehicles (MPV's) (52 FR 44898), NHTSA permitted the use of Hybrid III test dummies for compliance testing of those vehicle types. The dummy positioning issues that were raised in the petitions for reconsideration of the Hybrid III dummy had to be resolved in that rule, to allow the Hybrid III dummies to be properly positioned during compliance testing. Although that rule addressed only light trucks and MPV's, the positioning problems in those vehicle types are similar to the positioning problems for passenger cars. Accordingly, the dummy positioning procedures set forth therein are applicable to positioning the Hybrid III test dummy in any type of vehicle, including passenger cars. Persons interested in reviewing the agency's response to the Hybrid III test dummy positioning issues raised in the petitions for reconsideration should consult that document. This notice addresses all other issues raised in the petitions for reconsideration of the final rule establishing requirements for the Hybrid III test dummy.

Chest Deflection Limits

The chest deflection limits generated the most requests for reconsideration. Chrysler, Ford, GM, Honda, the Motor Vehicle Manufacturers Association (MVMA), Nissan, Renault, Toyota, Volkswagen, and Volvo all asked for some changes to these requirements. GM stated that it uses a two inch deflection limit as an internal design and performance guide in its development of belt restraint systems. However, GM stated that there is no biomedical basis for such a limit. GM concluded by stating that it believed a two inch chest deflection limit was overly conservative as a mandatory requirement and that a three inch limit would be a more appropriate regulatory requirement.

Toyota stated that the two inch limit was unreasonable. Toyota stated that it has no knowledge of any accidents in which occupants of a Cressida equipped with this automatic belt system have

suffered serious chest injuries. Yet, according to this petitioner, in 30 miles per hour (mph) barrier impact tests using the Hybrid III test dummy, the 2-point automatic belt system installed in its Cressida model causes chest deflections that average 2.3 inches, with a maximum of 2.9 inches. Thus, these vehicles would not comply with the two inch chest deflection limit. Toyota asserted that retention of the two inch chest deflection limit would force it to discontinue offering this 2-point automatic belt system, even though accident data indicate that the system offers effective occupant protection. Toyota urged the agency to increase the chest deflection limit to three inches for all restraint systems. Volkswagen made a similar point with respect to the 2-point automatic belt system installed in its Golf models, as did Chrysler for the 2-point automatic belt systems installed in some of its models.

Volvo stated that the data on which NHTSA had based the two inch deflection limit were inadequate to provide conclusive evidence of biomechanical tolerance levels. Renault requested the agency to amend the chest deflection limit to 2.5 inches until the uncertainties associated with the test data, which were the basis for the two inch limit, are fully resolved. MVMA asked that the two inch limit be suspended until the agency had resolved the issues surrounding this aspect of occupant protection.

Restrained Hybrid III dummies. In response to these petitions, NHTSA has thoroughly reexamined this subject. The agency has no basis for questioning its previous statements that the Hybrid III can underestimate actual chest deflections in certain circumstances. Further, after again reviewing the available biomechanical data, the agency continues to believe those data suggest the need to establish a chest deflection limit for restraint systems that do not evenly distribute the load over the entire thorax surface at some level below three inches.

If the biomechanical data were complete and reliable, the agency could rely on these data alone as the primary support for a particular chest deflection limit somewhere below three inches. However, the currently available biomechanical data are limited. NHTSA believes that it should not rely on these biomechanical data *alone* to support a particular chest deflection limit. Even when the agency's concern about the Hybrid III dummy's propensity to underestimate actual chest deflection in certain situations is combined with the available biomechanical data, the agency cannot demonstrate at this time that a two inch chest deflection limit is necessary to meet the need for safety.

The most broad-based data source available for examination when establishing a new chest deflection limit is the accident files for the restraint systems currently in production. As noted above, those accident files show that current 2- and 3-point safety belts, when used, afford a high level of protection against serious thorax injuries. When the agency adopted the two inch chest deflection limit, the data available to the agency indicated that existing 2- and 3-point safety belt systems would not have to be redesigned to comply with this requirement. In the case of 2-point automatic belts, the available data consisted of 1982 and 1984 Volkswagen Rabbit tests. This testing showed chest deflections of 1.09 and 1.06 for the Hybrid III dummy at the driver's position, and chest deflections of 0.79 and 0.86 inch for the Hybrid III dummy at the passenger's position. Based on these test results, the agency had no reason to believe that existing 2-point automatic belt systems would have to be redesigned to comply with the two inch chest deflection limit.

However, manufacturers of vehicles with 2-point automatic belt systems submitted new test results as part of their petitions for reconsideration, showing that their existing belt systems do not comply with a two inch chest deflection limit. As noted above, Toyota and Chrysler submitted test results showing that their models with 2-point automatic belt systems would not comply with a two inch chest deflection limit. Most significantly, Volkswagen submitted test data for its 1987 Golf model. This vehicle uses a very similar design of 2-point automatic belts to that which was present in the 1982 and 1984 Rabbit models that were tested by the agency. Volkswagen's testing of this 1987 Golf showed that the Hybrid III test dummies at both the driver and the passenger positions experienced chest deflections of 2.3 inches. These chest deflections are significantly higher than those measured in the NHTSA testing. Both Volkswagen and MVMA alleged in their petitions for reconsideration that a scaling error may account for the large differences in test results for what is essentially the same restraint system. Both petitioners stated that the agency may have improperly converted centimeters to inches. Volkswagen showed that when the NHTSA results were multiplied by 2.54 (the number of centimeters in one inch), the NHTSA and Volkswagen data show very good agreement.

In response to these allegations, NHTSA has begun an investigation of its previous test results. The preliminary conclusion from that investigation is that the discrepancy between the NHTSA and Volkswagen test results cannot be definitely attributed to a data processing scaling error in the NHTSA data. However, it concluded that those previous test results must be regarded as highly suspect.

Subsequent sled tests by NHTSA using Volkswagen Golf interiors produced chest deflections substantially greater than the results of the previous NHTSA crash testing of Volkswagen Rabbits. For example, this subsequent sled testing of a Golf showed a chest deflection of 2.8 inches for the current design of the Golf interior and restraint system. The agency then made several modifications to the Golf interior and restraint system to explore the sensitivity of the parameters that influence the magnitude of measured chest deflection. One of these modifications resulted in a chest deflection of 1.9 inches. However, this modification increased the HIC level to 2362. None of the chest deflections measured in these 11 tests of the Golf were near the level of 1.09 inches measured in the previous NHTSA testing of the Rabbit, and all but the one modification discussed above had chest deflections above two inches.

Additionally, the agency has also conducted several 30 mph frontal impact tests of vehicles equipped with 2-point automatic belts. The Chrysler LeBaron had a chest deflection of 2.35 inches at the driver's position and 2.56 inches at the passenger's position. The Subaru XT had a chest deflection of 2.48 inches at the driver's position and 2.61 inches at the passenger's position. The Toyota Camry had a chest deflection of 1.66 inches at the driver's position and 2.15 inches at the passenger's position. These results likewise are substantially greater than the chest deflection of 1.09 inches measured for the Volkswagen Rabbit in the agency's previous testing.

The subsequent testing by NHTSA and by the manufacturers has not been able to replicate the results of NHTSA's previous testing of 2-point automatic belts. To date, the agency has not been able to identify the source(s) of the discrepancies between current and previous test results. Accordingly, the agency believes that it cannot rely on the chest deflection measurements obtained in that previous round of testing for any purpose until such time as the agency can explain or replicate those results.

Data available to the agency indicate that most of the two point belt systems currently offered and some three point belt systems could not comply with the two inch chest deflection limit. Moreover, the accident data for vehicles equipped with restraint systems that do not comply with the two inch chest deflection limit do *not show* that persons restrained by these belt systems experience a higher level of chest injuries in crashes than those restrained by belt systems that comply with the two inch chest deflection limit. Given these accident data and the acknowledged limitations of the available biomechanical data, the agency has concluded that it does not have an adequate basis for imposing a two inch chest deflection limit at this time. Accordingly, this notice amends the chest deflection level upward.

The remaining question is what level should be established as the limit for permissible chest deflection. As noted above, agency sled tests have measured a 2.8 inch chest deflection for the Volkswagen Golf. NHTSA vehicle tests measured chest deflections of 2.56 inches in the Chrysler LeBaron and 2.61 inches in the Subaru XT. In one of Toyota's tests, a chest deflection of 2.9 inches was measured in its Cressida model. The agency currently has no field evidence that persons restrained by the restraint systems in these vehicles are exposed to an unacceptable risk of serious chest injuries. Therefore, this notice amends the chest deflection limit for Hybrid III test dummies to specify that the chest deflection shall not exceed three inches for any occupant protection system.

Unrestrained Hybrid III dummies. As noted above, the available accident data suggest that, when the impact forces that produce 2.9 inches of chest deflection in the Hybrid III test dummy are imposed on the human chest by 2-point belts, those forces appear not to expose vehicle occupants to a significant risk of serious chest injury. Similarly, NHTSA has test data showing that, when the forces that produce 2.7 inches of chest deflection in the Hybrid III test dummy are imposed on the human chest by air bags, those forces appear not to expose vehicle occupants to a significant risk of serious chest injury. Accordingly, the agency believes that a three inch chest deflection limit for the Hybrid III test dummy when restrained by safety belts or air bags appears to meet the need for motor vehicle safety.

In both the NPRM and the final rule adopting the Hybrid III test dummy, the agency treated all occupant protection systems other than those that were "gas inflated and provide distributed loading to the torso during a crash" as a single category. This treatment had the effect of establishing the

same chest deflection limit for Hybrid III dummies that were restrained by safety belts and those that were unrestrained. Following this same reasoning, one would infer that since the three inches of chest deflection in the Hybrid III dummy can safely be tolerated by vehicle occupants when those forces are imposed by safety belts, that same level of chest deflection could be safely tolerated when it is imposed on unrestrained vehicle occupants.

However, the accident data and the limited biomechanical data that are currently available for unrestrained occupants raise concerns about the decision to assign the same chest deflection limit to unrestrained and belt-restrained occupants. To respond to these concerns, NHTSA believes that it should reexamine the basis for its decision to establish the same chest deflection limit for belt-restrained and unrestrained Hybrid III test dummies.

Moreover, the preamble to the final rule establishing the Hybrid III test dummy expressed the agency's concerns about the equivalence of the Hybrid III test dummy and the Part 572 Subpart B test dummy, relying solely on data gathered when both types of test dummies were *unrestrained*. The equivalence of the two test dummies is essential if the agency is to ensure that permitting a choice of test dummies will not lead to a degradation in vehicle safety performance. That is, both test dummies must reach similar conclusions in identifying vehicle designs that could cause or increase occupant injury. Based on a review of all available data comparing the test responses of the two dummies, the agency concluded that there was no consistent trend for either test dummy to measure higher or lower Head Injury Criterion (HIC) or femur measurements than the other. With respect to chest acceleration responses, however, the preamble explained the following:

> In the case of chest acceleration measurements, the data again do not show higher or lower measurements for either test dummy, except in the case of unrestrained tests. In unrestrained tests, the data show that the Hybrid III generally measures lower chest g's than the existing Part 572 test dummy. This difference in chest g's measurement is one reason why the agency is adopting the additional chest deflection measurement for the Hybrid III, as discussed further below. 51 FR 26688, at 26694; July 25, 1986.

Later, the preamble said:

> In summary, the test data indicate the chest acceleration responses between the Hybrid III and the existing Part 572 test dummy are about the same for restrained occupants, but differ for some cases of unrestrained occupants. This is to be expected since a restraint system would tend to make the two dummies react similarly even though they have different seating postures. The different seating postures, however, would allow unrestrained dummies to impact different vehicle surfaces, which would in most instances produce different responses. Since the Hybrid III dummy is more human-like, it should experience loading conditions that are more human-like than would the existing Part 572 test dummy. One reason that the agency is adding chest deflection criteria [*sic*] for the Hybrid III is that the unrestrained dummy's chest may experience more severe impacts with vehicle structures than would be experienced in an automatic belt or air bag collision. Chest deflection provides an additional measurement of potential injury that may not be detected by the chest acceleration measurement. *Id.*, at 26694-95.

NHTSA's 1986 determination that the Hybrid III and the Part 572 Subpart B test dummies were nevertheless equivalent test devices for unrestrained occupants was based on the addition of a chest deflection limit for unrestrained Hybrid III test dummies. The chest deflection limit was established at two inches, based primarily upon data that had been gathered for *belt-restrained* occupants. However, today's notice has amended the chest deflection limit for Hybrid III test dummies to three inches, based in part on the inadequate support for the two inch value. Despite our acknowledgement of the limitations in the support for the two inch value, NHTSA is also concerned that none of the limited available data indicate that a three inch chest deflection limit for *unrestrained* Hybrid III test dummies is the correct value to make the Hybrid III test dummy equivalent to the Part 572 Subpart B test dummy.

Given the limitations of the available data to support any particular chest deflection value for unrestrained occupants and the concerns about the equivalence of the Hybrid III and Subpart B test dummies without a two inch chest deflection limit, the agency has concluded that it should not permit the Hybrid III dummy to be used until September 1, 1990, to test vehicles that do not use any restraint systems (such as automatic safety belts or air bags) to provide automatic occupant protection. This period of time will allow the agency to gather and analyze additional data, so

that it can determine whether a chest deflection limit of less than three inches is necessary for unrestrained Hybrid III test dummies, and, if so, what specific limit should be proposed.

Furthermore, the agency has already determined that the injury criteria applicable to unrestrained Subpart B test dummies are reasonably correlated to the tolerance limits of unrestrained vehicle occupants. Accordingly, mandating the use of the Subpart B test dummy until September 1, 1990, for compliance testing of vehicles that do not use restraints to provide occupant protection will ensure that any such vehicles afford a level of occupant protection equivalent to that afforded by vehicles that use restraint systems.

The agency would like to make clear that the available data do *not* establish that the three inch chest deflection limit for unrestrained Hybrid III test dummies fails to meet the need for safety or fails to ensure equivalence with the Subpart B test dummy. To repeat, the agency has always treated unrestrained and belt-restrained Hybrid III dummies as a single category for the purposes of chest deflection throughout this rulemaking. If the agency were to continue following this course, there would be no reason for the temporary delay in the use of the Hybrid III for certain types of vehicles. However, the accident data and the limited biomechanical data that are available suggest that it would not be appropriate to continue to treat belt-restrained and unrestrained Hybrid III test dummies in a single category for purposes of the chest deflection limit. The agency wants to investigate this subject further, to ensure that the chest deflection limit that is established for unrestrained Hybrid III dummies both meets the need for safety and ensures that these dummies are equivalent to the Subpart B test dummy in similar conditions.

If the agency cannot substantiate its concerns with data by the time this temporary delay in the use of the Hybrid III dummy for some vehicles expires, NHTSA will assume that it is reasonable to continue imposing a single chest deflection limit for belt-restrained and unrestrained Hybrid III dummies. Accordingly, *unless* there is some future rulemaking action in this area, this rule provides that vehicles that do not use any restraint systems to provide occupant protection and that are manufactured on or after September 1, 1990, *may* use the Hybrid III test dummy with the three inch chest deflection limit in Standard No. 208 compliance testing.

The agency is not aware of any manufacturer's plans to certify a vehicle design as complying with Standard No. 208 without including any automatic restraint system before September 1, 1990. Hence, this temporary delay in the use of the Hybrid III for testing vehicles without any automatic restraint systems should not adversely affect any manufacturer. After this temporary delay has expired, the Hybrid III dummy will be available for compliance testing for any type of occupant protection system a manufacturer may certify as complying with Standard No. 208. This reflects the agency's continuing belief that the Hybrid III test dummy should eventually replace the older Subpart B test dummy as the tool used to evaluate the protection that *all* vehicles afford occupants during frontal crashes, including vehicles that do not use any restraint systems to protect the occupants, because of the Hybrid III's enhanced biofidelity and capability of measuring injury producing forces for areas of the body that are not measured by the Subpart B test dummy.

Mandatory Use Date for Hybrid III

There are a number of questions that are currently unresolved regarding the injury criteria that should be established for the Hybrid III dummy. The following are some of the issues that need to be addressed to develop sound injury criteria for that test dummy:

1. What is the extent of the occupant chest injury problem in real world motor vehicle crashes? How does the problem vary by restraint system type?
2. Is chest deflection a relevant chest injury measure, in addition to chest acceleration, when using the Hybrid III test dummy?
3. What process should be used to correlate laboratory-based test data about chest injuries with the actual accident data for chest injuries?
4. How accurate and valid are the current chest deflection measurement technology and any current technological alternatives for assessing chest injury potential (such as measurements of shoulder belt loading)?
5. To what extent should the performance requirement limiting chest deflection differentiate among the various types of restraint systems?
6. Are the responses of the Hybrid III test dummy adequately repeatable when used to measure the chest deflection of various types of restraint systems?

The available data are inadequate to permit the agency to resolve these questions with a reasonable degree of confidence. Until the agency has a reasonable confidence in its answers to these types of questions, NHTSA believes it would premature to mandate the use of only this test dummy for compliance testing under Standard No. 208. Accordingly, this notice suspends the mandatory use date for the Hybrid III test dummy. The July 1986 final rule had established September 1, 1991, as the date after which NHTSA would use only the Hybrid III test dummy for its passenger car compliance testing under Standard No. 208.

NHTSA has already initiated further testing of current restraint systems with the Hybrid III test dummy. In addition, the agency intends to broaden its biomechanical data base to fill in the gaps in the existing data regarding the appropriateness of limits on permissible chest deflection. NHTSA will also attempt to correlate the biomechanical data, Hybrid III chest deflections and/or related injury assessments, and injuries observed in vehicle crashes. Finally, the agency will gather more chest deflection and injury data from vehicle test crashes. After the agency has performed this additional research, it will propose a new mandatory use date for the Hybrid III dummy in Standard No. 208 compliance testing.

In connection with this suspension of the mandatory use date for the Hybrid III dummy in NHTSA's compliance testing, the agency emphasizes that it is aware of the need to allow all manufacturers to obtain and gain experience with using the Hybrid III dummy *before* that test dummy is used for passenger car compliance testing. NHTSA previously determined that at least four years should be allowed for manufacturers to gain experience with the Hybrid III, after those test dummies were commercially available in sufficient quantities; 51 FR 26688, at 26699, July 25, 1986. When proposing a new mandatory use date for the Hybrid III, NHTSA will again specify a leadtime that is adequate to allow all manufacturers to gain experience with the Hybrid III test dummy. Because of the problems that have arisen vis-a-vis chest deflection, NHTSA will not include the time that has elapsed since the July 25, 1986, final rule in its leadtime estimate.

Other Issues Raised in Petitions for Reconsideration

As noted above, all issues related to the Hybrid III positioning procedures that were raised in these petitions for reconsideration were addressed in the November 23, 1987, final rule establishing dynamic testing requirements for light trucks and light multipurpose passenger vehicles (52 FR 44898). Interested persons are referred to that rule if they wish to review the agency's response to those issues. Besides the issues of the appropriate chest deflection limits, the mandatory use date for the Hybrid III test dummy, and the positioning procedures, the following issues were raised in petitions for reconsideration.

1. *Acceptability of the Hybrid III's Design and Performance Specifications.*

Ford commented that the performance requirements for Hybrid III test dummies that were specified in the final rule were based on versions of the Hybrid III that reflected the proposed requirements. However, the version of the Hybrid III mandated in the final rule includes new rib damping material, knee sliders, ball-joint ankles, and so forth. Ford asserted that the performance requirements in the final rule may not have taken these changes into account. In addition to the changes noted by Ford, the requirements for the Hybrid III dummy specified in the final rule differed from those proposed with respect to the calibration procedures to be followed.

Ford's assertion that the agency failed to account for the changes made to the test dummy between the proposal and the final rule is not correct. In the case of the new rib damping material, data submitted by GM (Docket No. 74-14-N 45-027) and testing conducted for NHTSA show that the new rib damping material shifts the impact force response calibration limits upward by about six percent, but has little or no effect on the chest deflection characteristics.

The design changes to the knee, lower leg, and ankle were made to reduce the dummy's design complexity which, in turn, should enhance the dummy's reproducibility. The size, mass, mass distribution, and rigidity of the knee, lower leg, and ankle are identical to those which were proposed. Additionally, NHTSA conducted its testing of the Hybrid III dummy's knees with the proposed knees, that is, *without* a shear module. GM conducted its testing of the dummy's knees with the knees adopted in the final rule, that is, *with* the shear module. The agency and GM test results for the knees were nearly identical. These test results show that the addition of the knee shear module did not significantly affect the performance of the knees in testing.

Ford did not offer any explanation of why it believes the changes to the knee, lower leg, and ankle would affect the performance of the Hybrid III dummy during testing. The dummy calibration modifications that were made between the proposal and the final rule simply reduced the complexity and redundancy of the calibration procedures. The available evidence indicates that the only effect on the performance of the Hybrid III as a result of the calibration modifications was to ensure that the test dummy produces more consistent impact responses. Accordingly, NHTSA has not amended the rule in response to Ford's concern.

2. *Calibration Requirements.*

The calibration procedures involve a series of static and dynamic tests of the test dummy components to determine whether the responses of the dummy fall within specified ranges. These calibration procedures help ensure that the test dummy has been properly assembled and that the assembled test dummy will give repeatable and reproducible results during crash testing.

a. *Thorax calibration response requirements.* In its petition, Ford asked NHTSA to revise the thorax calibration specifications to reflect the characteristics of the rib cage structure with the new United McGill rib damping material. NHTSA changed to this new rib damping material after proposing to use a different rib damping material. Ford also indicated that it has experienced some intermittent difficulties in getting its Hybrid III dummies to comply with the thorax calibration requirements. Honda, Volkswagen, and Toyota also indicated they had experienced problems with getting Hybrid III dummies to meet the thorax calibration requirements. These three manufacturers also indicated that they had difficulties obtaining consistent thorax impact responses. GM urged the agency to revise the midpoint of the thorax resistive forces specified in the calibration requirements upwards by 47.5 pounds. GM stated that this increase would more appropriately reflect the range of acceptable responses for newly manufactured Hybrid III test dummies incorporating the new rib damping material.

The agency believes that these petitions raise a legitimate point. NHTSA confirmed in its own testing and testing conducted by the Hybrid III dummy manufacturers that the rib design specification set forth in the final rule is too broad. The dimensional extremes permissible under that specification result in the test dummy's thorax exhibiting excessive impact response variations. During the months of November and December 1986, a series of round robin tests were conducted by the two dummy manufacturers and GM to determine what rib steel and damping material combinations would produce the most consistent impact responses, while ensuring biofidelity with the human rib cage. Those tests indicated that a rib steel thickness of 0.080 inch and 0.53 inch thickness of the new rib damping material would yield the most consistent responses and retain biofidelity (NHTSA Docket No. 74-14-N45-027). However, this report also concluded that the calibration force requirements should be adjusted upwards by 80 pounds.

Subsequently, the agency performed a similar series of tests of the rib cages made by both dummy manufacturers to ensure that rib cages that comply with these new specifications could be calibrated within the higher force levels and that rib cages that comply with these new specifications and that are calibrated at the higher force levels yield consistent impact responses. These tests showed that both dummy manufacturers can produce Hybrid III rib cages well within these new specifications and that both manufacturers' rib cages built to these new specifications gave repeatable and reproducible impact responses. (NHTSA Docket No. 74-14-N45-038).

Therefore, in response to the petitions and these test results, §572.34(b) is revised to specify that the thorax shall resist a force of 1242.5 ± 82.5 pounds. This is an increase of the midpoint force level by 80 pounds, or about six percent, over the previously specified level. The specifications for rib steel thickness have been narrowed from 0.078 ± 0.002 inch to 0.080 ± 0.001 inch. The specifications for rib damping material thickness are revised from a range of 0.250-0.625 inch to a range of 0.53 ± 0.03 inch. These changes should ensure that the Hybrid III thorax will yield more consistent impact responses.

b. *Knee impact calibration responses.* Ford stated in its petition for reconsideration that the knee impact calibration should be conducted without the lower leg attached. In support of this request, Ford stated that it is hard to accurately measure the required angle specified for the lower leg, using the new lower leg. Additionally, Ford noted that §572.35(c) requires the use of the new lower leg for knee impact testing, while Figure 24 shows the lower leg that was proposed, but not adopted in the final rule.

The agency was not persuaded by this argument. First, the agency has not encountered any

problems in its testing with rotating the leg to the specified angle and maintaining it in the correct orientation. Ford did not explain what specific difficulties it has encountered. Second, removal of the lower leg would require the dummy to be disassembled during the calibration procedures. This would add time and effort to the calibration process with no corresponding benefit. Hence, this suggested change has not been adopted.

Additionally, Ford's suggestion that Figure 24 needs to be revised to show the version of the lower leg adopted in the final rule is not persuasive. The proposed lower leg included instrumentation on the tibia, while the final rule specified a non-instrumented tibia. There were no other differences in the lower leg. Figure 24 merely shows a lower leg, without identifying any particular lower leg by a part number or the like. The identification of the lower leg in §572.35 correctly identifies the leg assembly with a non-instrumented tibia. Hence, no clarifying amendments are necessary.

Both Ford and GM stated that the knee impact calibration tolerances were overly broad in the final rule. That rule specified a tolerance of ± 22 percent, with an acceptable variation of 44 percent (not less than 996 pounds nor more than 1566, with a midpoint of 1281 pounds),. Ford stated that potential test variability would be significantly reduced if the range were narrowed to ± 10 percent (not less than 1153 pounds nor more than 1409 pounds, with the midpoint remaining at 1281 pounds).

Based on a series of round robin tests between NHTSA and itself, GM also stated that the range of acceptable knee impact force requirements is too broad, especially when compared with the typical knee impact responses of newly manufactured Hybrid III dummies. GM recommended, based on the round robin testing, that the calibration performance requirements be modified to be not less than 1060 pounds nor more than 1300 pounds. This would lower the midpoint of the acceptable range to 1180 pounds, and would fall within the ± 10 percent tolerance limit suggested by Ford.

After reconsidering this issue, NHTSA agrees with Ford and GM that the knee impact response range specified in the final rule is too broad. The knee response is governed primarily by the flesh covering the knee. It is relatively simple to control the consistency of this flesh when manufacturing new dummies, and relatively simple to replace the flesh on used dummies, when the response falls out of the acceptable calibration range. Based on the round robin testing, this notice adopts GM's suggested calibration range of 1060-1300 pounds. NHTSA and GM testing showed that this range is practicable and relatively simple to attain. This narrower range should also yield more repeatable impact responses from the Hybrid III dummies in crashes.

c. *Conforming changes to the drawings and specifications package for the Hybrid III test dummy.* As a part of the amendments to the calibration specifications and to correct errors in the previous package, NHTSA is making some changes to the drawings and specifications package for the Hybrid III test dummy. These changes consist of the following:

i) a revised rib thickness specification;

ii) a revised rib damping material specification;

iii) a revised rib cage assembly specification (to reflect the changes in i) and ii));

iv) a new abdominal insert specification (to eliminate possible interference by the insert with the lever arm of the chest deflection potentiometer);

v) a new specification for the pelvis angle during thorax calibration tests; and

vi) an update of the dummy assembly drawing to reflect these changes.

3. *Chest Temperature Sensitivity.*

The final rule provided that the stabilized temperature of the Hybrid III test dummy is to be between 69° and 72° F for the Standard No. 208 compliance testing. This narrow temperature range is necessary, because testing has shown that the Hybrid III test dummy's measurements of chest deflection and chest acceleration are temperature sensitive. The agency stated that it believed this temperature range was practicable.

Ford stated that its barrier crash facility cannot maintain the specified temperature range. However, Ford recommended that the temperature range could be broadened because "the new rib damping material will probably exhibit somewhat different temperature sensitivity." Based on this assumption, Ford suggested that the temperature range be broadened by 2° to 5° F. As an alternative to broadening the temperature range, Ford suggested that this narrow temperature range be applied only to the dummy components that have shown great temperature sensitivity, and that the dummy components that do not exhibit temperature sensitivity should not be subject to tight temperature controls.

According to Mazda's petition for reconsidera-

tion, the specified temperature range can only be maintained with separate on-board air conditioning, and such an arrangement would limit the number and variety of tests that were possible. Like Ford, Mazda asserted that the reduced temperature sensitivity of the new rib damping material would permit the agency to expand the permissible temperature range, which Mazda suggested be set at 68° to 76° F. Honda stated that its test facility could control the temperature within 8° F and urged that the permissible temperature range be expanded to an 8° F limit. Volvo stated that the permissible temperature range is practicable, but that it is excessively time consuming and complicated, especially because the test cycle has to be interrupted frequently for various technical reasons unrelated to temperature.

Contrary to the assertions by some of these petitioners, test data available in the public docket (NHTSA Docket No. 74-14-N39-049) show that the new rib damping material has nearly the identical temperature sensitivity as the damping material it replaces. If the agency were to establish a broader temperature range for the testing, it would introduce excessive variability into the compliance test results. The preamble to the final rule discussed at length the several means that the agency and its contractors have used to maintain the temperature within the specified range (51 FR 26692). In addition, in a submission to the docket, General Motors indicated successful use of temperature normalization factors which a manufacturer may want to use to predict response values at the exact specified mean temperature. NHTSA has concluded that the specified temperature range is practicable and necessary to reduce variability of the test results, so this provision has not been changed in this notice.

4. *Dummy Durability.*

Nissan stated that in 35 mph sled tests, its Hybrid III test dummy had experienced damage to the neck, rib cage, and wrists. Similarly, Volvo stated in its petition for reconsideration that the Hybrid III dummy is less durable in 35 mph impacts than the currently specified test dummy. Additionally, Volvo stated that the thorax needs more frequent replacement in 35 mph impacts than was stated by the agency. In the preamble to the final rule, the agency said that testing had shown that Hybrid III dummies could be used for about 17 crash tests before the ribs must be replaced, and concluded that this level of durability was reasonable. Volvo did not provide any data to support its assertions.

The agency has not examined the durability of the Hybrid III test dummy in 35 mph impact tests. However, the agency does not believe this issue is relevant to the announced use of the Hybrid III test dummy. The final rule specified that the Hybrid III dummy would be used in compliance testing for Standard No. 208, which requires 30 mph impacts. If and when the agency decides to use the Hybrid III dummy in testing for the New Car Assessment Program, which involves 35 mph frontal impacts, the agency will examine the durability of the dummy in 35 mph frontal impacts. Until such a decision is made, NHTSA believes that its resources can be better spent examining other issues related to the Hybrid III test dummy.

During extensive testing in 30 mph impacts conducted for NHTSA and manufacturers, the Hybrid III dummy has demonstrated adequate durability under those conditions (NHTSA Docket No. 74-14-GR-602). To the extent that the durability of the Hybrid III thorax may have been in question, agency testing has shown that Hybrid III test dummies with the new ribs and new rib damping material show minimal changes in force and deflection responses of the thorax after 20 consecutive pendulum impacts. After the 20th impact, the rib cage force and deflection response levels had changed less than 3 percent from the mean responses of the first four impacts. (NHTSA Docket No. 74-14-N45-038). Based on these test results, NHTSA concludes that the Hybrid III test dummy has adequate durability in 30 mph impacts.

5. *Changes to the Text of Standard No. 208 and Part 572.*

Chrysler, Ford, and MVMA all requested the addition of text to sections S7.4.3-S7.4.5 to permit use of the Hybrid III test dummy to test compliance with the comfort and convenience requirements of S7.4. The final rule establishing dynamic testing requirements for light trucks and multipurpose passenger vehicles has already amended section S7.4.4 to permit the use of either type of test dummy for such testing. This notice makes similar changes to sections S7.4.3 and S7.4.5.

Renault asked that Standard No. 208 be clarified as to the question of whether the two dummy types may be used interchangeably in the driver and/or passenger positions. NHTSA has previously concluded that both dummy types yield equivalent safety assessments of vehicles. Therefore, until the time when only the Hybrid III test dummy is used for compliance testing, NHTSA believes manufacturers should be allowed to base

their certifications of compliance on the use of either type of test dummy in any combination and in any of the designated seating positions. Language to this effect has been added to Standard No. 208.

Ford also suggested some technical changes to clarify certain parts of Standard No. 208 and Part 572. Ford stated that section S6.2.3 of Standard No. 208 currently provides that, "The resultant acceleration calculated from the thoracic instrumentation . . . ." Ford stated that the acceleration is calculated from the output signal of the instrumentation, not from the instrumentation itself, and asked that the language be amended to state that. The agency agrees, and has made this change.

Ford stated that the positive and negative signs had been reversed in section 572.33(b)(1)(ii) and (b)(2)(ii). This statement is incorrect. According to the sign convention for the output of the Hybrid III transducers referenced in §572.31(a)(5) and sign conventions adopted by the Society for Automotive Engineers (SAE) Instrumentation Subcommittee, the positive and negative signs were correctly used in the sections questioned by Ford.

Ford also asked that the definition of and references to "time zero" be deleted from §572.34(b), because the agency had deleted the proposed specifications that thorax load be measured 19 milliseconds after impact and that thorax displacement be measured 25 milliseconds after impact. Because of these deletions, Ford asserted that the references and definition of time zero were unnecessary and potentially misleading. NHTSA agrees with this point, and this rule has amended §572.34 to delete the reference to "time zero."

Impact Assessments

1. *Economic and Other Impacts.* NHTSA has considered the impacts of this response to the petitions for reconsideration of the final rule on the Hybrid III test dummy and determined that it is neither "major" within the meaning of Executive Order 12291 nor "significant" within the meaning of the Department of Transportation's regulatory policies and procedures. The several technical corrections made by this notice should not significantly affect the cost estimates set forth in the final regulatory evaluation that was prepared in connection with the final rule on the Hybrid III test dummy. Interested persons are referred to that document, which is available in NHTSA Docket No. 74-14, Notice 45. Copies of that regulatory evaluation may be obtained by writing to: NHTSA Docket Section, Room 5109, 400 Seventh Street, S.W., Washington, D.C. 20590, or by calling the Docket Section at (202) 366-2992.

The most important changes made in this response to the petitions are the amendment of the chest deflection limit, the delay until September 1, 1990, in using the Hybrid III dummy for compliance testing of vehicles that don't use restraint systems to provide automatic occupant protection, and the suspension of the mandatory effective date for use of the Hybrid III dummy. The amendment of the chest deflection limit for the Hybrid III dummy is necessary to ensure that the adoption of a new compliance test device does not require the redesign of most existing designs of 2-point automatic belt systems. Amending the chest deflection limit to three inches both recognizes the effectiveness of existing 2-point automatic belt systems and avoids unnecessary adverse impacts on any party.

The temporary delay in the use of the Hybrid III test dummy for compliance testing of vehicles that provide automatic occupant protection without using any restraint systems is necessary to allow the agency to further examine its decision to establish the same chest deflection limits for those systems and systems that use either safety belts or air bags. No manufacturer currently certifies any such vehicle design, nor is the agency aware of any plans to certify such a vehicle design before September 1, 1990. Hence, this temporary delay should not adversely affect any person.

The suspension of the effective date for mandatory use of the Hybrid III test dummy is necessary to permit the agency to resolve some remaining technical issues, principally related to chest deflection. The agency does not believe that postponing the mandatory use date for the Hybrid III test will have any adverse impact on any person. Those manufacturers that wish to certify their vehicles on the basis of testing with the Hybrid III test dummy are permitted to do so. Those manufacturers that wish to certify their vehicles on the basis of testing with the Part 572 Subpart B dummy are also permitted to do so. Once the agency has resolved the outstanding technical issues associated with the Hybrid III test dummy, a new date for the mandatory use of that test dummy in NHTSA's compliance testing will be proposed through the rulemaking process. That rulemaking will consider all the impacts associated with a new mandatory use date.

In consideration of the foregoing, 49 CFR §571.208, *Occupant Crash Protection*, and 49 CFR Part 572, *Anthropomorphic Test Dummies*, are amended as follows:

PART 571 — [AMENDED]

1. The authority citation for Part 571 continues to read as follows:

Authority: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

§571.208 [Amended]

2. S5 of Standard No. 208 is amended by revising S5.1 and S5.2.1 to read as follows:

S5. *Occupant crash protection requirements.*

S5.1 Vehicles subject to S5.1 shall comply with either S5.1(a) or S5.1(b), or any combination thereof, at the manufacturer's option; except that vehicles manufactured before September 1, 1990, that comply with the requirements of S4.1.2.1(a) by means not including any type of seat belt or inflatable restraint shall comply with S.5.1(a).

(a) * * *

(b) * * *

S5.2. *Lateral moving barrier crash test.*

S5.2.1 Vehicles subject to S5.2 shall comply with either S5.2.1(a) or S5.2.1(b), or any combination thereof, at the manufacturer's option; except that vehicles manufactured before September 1, 1990, that comply with the requirements of S4.1.2.1(c) by means not including any type of seat belt or inflatable restraint shall comply with S5.2.1(a). * * * * *

3. S6.2 of Standard No. 208 is amended by revising S6.2.3a and S6.2.4 to read as follows:

S6.2 *Injury Criteria for the Part 572, Subpart E, Hybrid III Test Dummy.* * * * * *

S6.2.3 The resultant acceleration calculated from the output of the thoracic instrumentation shown in drawing 78051-218, revision R incorporated by reference in Part 572, Subpart E, of this Chapter shall not exceed 60 g's, except for intervals whose cumulative duration is not more than 3 milliseconds.

S6.2.4 Compression deflection of the sternum relative to the spine, as determined by instrumentation shown in drawing 78051-317, revision A incorporated by reference in Part 572, Subpart E of this Chapter, shall not exceed 3 inches. *****

4. S7.4 of Standard No. 208 is amended by revising S7.4.3 and the first sentence of S7.4.5 to read as follows:

S7.4 *Seat belt comfort and convenience.* * * * * *

S7.4.3 *Belt contact force.* Except for manual or automatic seat belt assemblies that incorporate a webbing tension-relieving device, the upper torso webbing of any seat belt assembly shall not exert more than 0.7 pound of contact force when measured normal to and one inch from the chest of an anthropomorphic test dummy, positioned in accordance with either S10 or S11 of this standard in the seating position for which that seat belt assembly is provided, at the point where the centerline of the torso belt crosses the midsagittal line on the dummy's chest. * * * * *

S7.4.5 *Retraction.* When tested under the conditions of S8.1.2 and S8.1.3, with anthropomorphic test dummies whose arms have been removed and which are positioned in accordance with either S10 or S11, or any combination thereof, in the front outboard designated seating positions and restrained by the belt systems for those positions, the torso and lap belt webbing of any of those seat belt systems shall automatically retract to a stowed position either when the adjacent vehicle door is in the open position and the seat belt latchplate is released, or, at the option of the manufacturer, when the latchplate is released. * * * * *

PART 572 — [AMENDED]

5. The authority citation for Part 572 continues to read as follows:

AUTHORITY: 15 U.S.C. 1392, 1401, 1403, 1407; delegation of authority at 49 CFR 1.50.

6. Section 572.31 is amended by revising paragraphs (a)(1), (a)(3), and (b) to read as follows:

§572.31 *General description.*

(a) The Hybrid III 50th percentile size dummy consists of components and assemblies specified in the Anthropomorphic Test Dummy drawing and specifications package which consists of the following six items:

(1) The Anthropomorphic Test Dummy Parts List, dated December 15, 1987, and containing 13 pages, and a Parts List Index, dated December 15, 1987, containing 8 pages.

* * *

(3) A General Motors Drawing Package identified by GM Drawing No. 78051-218, revision R, and subordinate drawings. * * * * *

(b) The dummy is made up of the following component assemblies:

Drawing No.	Revision
78051-61 Head Assembly — Complete	(T)
78051-90 Neck Assembly — Complete	(A)
78051-89 Upper Torso Assembly — Complete	(K)
78051-90 Lower Torso Assembly — Without Pelvic Instrumentation Assembly, Drawing No. 78051-59	(D)
86-5001-001 Leg Assembly — Complete (LH)	(E)
86-5001-002 Leg Assembly — Complete (RH)	(E)
78051-123 Arm Assembly — Complete (LH)	(D)
78051-124 Arm Assembly — Complete (RH)	(D)

7. Section 572.33 is amended by revising paragraph (b)(1)(i) to read as follows:

§572.33 *Neck.* * * * * *

(b) * * *

(1) *Flexion* (i) Plane D, referenced in Figure 20, shall rotate between 64 degrees and 78 degrees, which shall occur between 57 milliseconds (ms) and 64 ms from time zero. In first rebound, the rotation of Plane D shall cross 0 degrees between 113 ms and 128 ms. * * * * *

8. Section 572.34 is amended by revising paragraphs (a), (b), and (c)(2) to read as follows:

§572.34 *Thorax.*

(a) The thorax consists of the upper torso assembly in drawing 78051-89, revision K, and shall conform to each of the drawings subtended therein.

(b) When impacted by a test probe conforming to §572.36(a) at 22 fps ± 0.40 fps in accordance with paragraph (c) of this section, the thorax of a complete dummy assembly (78051-218, revision R) with left and right shoes (78051-294 and -295) removed, shall resist with a force of 1242.5 pounds ± 82.5 pounds measured by the test probe and shall have a sternum displacement measured relative to spine of 2.68 inches ± 0.18 inches. The internal hysteresis in each impact shall be more than 69 percent but less than 85 percent. The force measured is the product of pendulum mass and deceleration.

(c) *Test procedure.* (1) * * *

(2) Seat the dummy without back and arm supports on a surface as shown in Figure 23, and set the angle of the pelvic bone at 13 degrees plus or minus 2 degrees, using the procedure described in S11.4.3.2 of Standard No. 208 (§571.208 of this Chapter). * * * * *

9. Section 572.35(b) is revised to read as follows:

§572.35 *Limbs.*

(a) * * *

(b) When each knee of the leg assemblies is impacted, in accordance with paragraph (c) of this section, at 6.9 ft/sec ± 0.10 ft/sec by the pendulum defined in §572.36(b), the peak knee impact force, which is a product of pendulum mass and acceleration, shall have a minimum value of not less than 1060 pounds and a maximum value of not more than 1300 pounds. * * * * *

10. Section 572.36 is amended by revising paragraphs (b), (c), (d), (e), (f), and (h) to read as follows:

§572.36 *Test conditions and instrumentation.*

* * * * * * * *

(b) The test probe used for the knee impact tests is a 3 inch diameter cylinder that weighs 11 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.02 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(c) Head accelerometers shall have dimensions, response characteristics, and sensitive mass locations specified in drawing 78051-136, revision A, or its equivalent, and be mounted in the head as shown in drawing 78051-61, revision T, and in the assembly shown in drawing 78051-218, revision R.

(d) The neck transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 83-5001-008 or its equivalent and be mounted for testing as shown in drawing 79051-63, revision W, and in the assembly shown in drawing 78051-218, revision R.

(e) The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing 78051-136, revision A, or its equivalent, and be mounted as shown with adaptor assembly 78051-116, revision D, for assembly into 78051-218, revision R.

(f) The chest deflection transducer shall have the dimensions and response characteristics specified in drawing 78051-342, revision A, or equivalent, and be mounted in the chest deflection transducer assembly 78051-317, revision A, for assembly into 78051-218, revision R. * * * * *

(h) The femur load cell shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 78051-265 or its equivalent and be mounted in assemblies 78051-46 and -47 for assembly into 78051-218, revision R.

* * * * * * * *

Issued on March 11, 1988

Diane K. Steed
Administrator

53 F.R. 8755
March 17, 1988

PREAMBLE TO AN AMENDMENT TO PART 572 and FEDERAL MOTOR VEHICLE SAFETY STANDARD NO. 213

Anthropomorphic Test Dummies
(Docket No. 89-13; Notice 2)
RIN 2127-AB94

ACTION: Final rule.

SUMMARY: This notice amends NHTSA's specifications for the 3-year-old-child test dummy NHTSA uses to test child restraint systems. Specifications are provided for a new head which has a higher natural frequency response, and is therefore better suited for compliance testing than the present head assembly. In addition, generic specifications are set for two different types of accelerometers which may be used with the dummy.

DATES: The effective date for making these amendments to the CFR is August 27, 1990.

Until September 1, 1993, each 3-year-old-child test dummy NHTSA uses to test an add-on child restraint will incorporate, at the manufacturer's option, either the new head assembly specified in §572.16(a)(1) or the old head assembly specified in §572.16(a)(2).

Effective September 1, 1993, each 3-year-old-child dummy NHTSA uses to test an add-on child restraint will incorporate the new head assembly specified in §572.16(a)(1).

Beginning August 27, 1990, each 3-year-old-child dummy NHTSA uses to test a built-in child restraint incorporate's the new head assembly specified in §572.16(a)(1).

SUPPLEMENTARY INFORMATION:

Background. On July 11, 1989, NHTSA published a notice of proposed rulemaking (NPRM) concerning changes to the agency's specifications for the 3-year-old-child test dummy (54 FR 29071).

First, the agency proposed a new head assembly for the test dummy. The agency also proposed that, if the new specifications were adopted, dummies conforming to them would be used by the agency when evaluating both add-on and built-in restraints. (A built-in child restraint is one that is an integral part of a vehicle.)

This proposal was developed following the implementation on January 22, 1988 of amendments to Standard No. 213 establishing performance and test criteria expressly applicable to built-in restraint systems. Prior to that date, Standard 213 specified performance and test criteria suitable for add-on child restraint systems only. (An add-on restraint is any portable child restraint system.) In tests of add-on systems, the test environment is a standard vehicle seat assembly to which the restraint is attached by a lap belt. During testing, the dummy's head does not contact a rigid surface which is not part of the child restraint system.

During compliance testing of built-in restraint systems, the dummy's head may contact a rigid surface, because the performance of the built-in restraint in protecting the child is determined by testing the restraint in proximity to other parts of the vehicle interior, which may include rigid surfaces. The current head of the 3-year-old-dummy has a relatively low natural frequency response, which may cause it to give unreliable data when the head contacts a rigid surface. The agency believed there was an apparent need to adopt a head that has a natural frequency response (the frequency of a free vibration at which an elastic system starts to vibrate when impacted by a force) appropriate for measuring acceleration resulting from impact between the dummy head and rigid surfaces. (Issues relating to the reliability and validity of the new head as a test device were thoroughly discussed in the NPRM and will not be repeated here.)

Second, the agency proposed two different types of generically designated accelerometers based on frequency response characteristics and location specifications within the dummy. Any accelerometer system conforming with these specifications could be used with the dummy. NHTSA proposed the generic accelerometer specifications because manufacture of the particular accelerometer model specified in Part 572 has been discontinued, and because NHTSA tentatively concluded there was no necessity to specify another particular model for use in compliance testing. Any accelerometer that meets the proposed specifications, and is positioned in the test dummy at the specified reference points so that the seismic masses of each sensing element would be

aligned with the head and thoracic reference points, would give the same measurements as any other accelerometer with the equivalent impact response characteristics and positioning. NHTSA believed that generic accelerometer specifications would avoid difficulties associated with a particular accelerometer model when the manufacture of that model is discontinued.

Comments on the NPRM

New head design

NHTSA received six comments on the proposed changes. The University of Michigan (UM) strongly urged that the agency adopt the new head. The University said that UM has been using the new head in child restraint tests since the early 1980's, and because of the existing head's low natural frequency, would not consider returning to the use of the old design. Volvo Cars of North America also supported the proposed change to the new head, stating that "the change of material in the dummy head will avoid some of the interfering noise occurring in the old dummy head due to its low material frequency."

General Motors Corporation (GM) submitted initial and supplemental comments on the NPRM. In its initial comment, GM said it had yet to test the proposed dummy head, but expressed concern that "the 3-year-old-child dummy, with or without the new head, still lacks a reasonable level of impact response biofidelity." (GM's comment reflects the fact that, after NHTSA established specifications for the 3-year-old-child test dummy in 1979, GM petitioned the agency to reconsider whether the specified dummy was an appropriate test device. NHTSA analyzed GM's concerns about the dummy and found them to be without merit. Accordingly, the agency denied the petition (45 FR 82265; December 15, 1980).) GM did not provide any data or information in its initial comment to the NPRM that convincingly established that NHTSA should refrain from using the 3-year-old-child test dummy to test child restraint systems. In its supplemental comment, GM stated that it tested the proposed head assembly and found that head accelerations met the proposed calibration levels when a light coat of a silicone lubricant was applied between the head skin and skull prior to the test. Applying a lubricant is recognized by the Society of Automotive Engineers (SAE) as an acceptable practice and is used by the industry to bring other Part 572 test dummies into calibration specifications. GM stated that it agreed with the proposed specification and use of the new head assembly on the 3-year-old-child test dummy.

Ford supported the agency's objective of improving the testing capability of the 3-year-old-child dummy, but was concerned that the natural frequency of the proposed fiberglass head "still may have too low a natural frequency to eliminate ringing." Ford seemed to believe that the new head has a natural frequency "just above 1000 Hz," which would cause mechanical ringing of the head at or near that frequency in certain impacts. The commenter suggested that NHTSA consider developing a new dummy head with a structure of aluminum or magnesium, "to provide a natural frequency well above 1000 Hz."

Ford apparently was not aware that the natural frequency of the new head is 3,300 Hz, which is 3.3 times higher than the nominal class 1,000 filter cut-off frequency referenced in §572.21 and specified by the SAE for head impact response measurements ("Performance Measurements of Three-Year-Old-Child Test Dummy Heads, December 1983; Report No. DOT HS 806-742). That natural frequency is considerably higher than that of the current head (400 Hz). Because the adequacy of the new head has been established by NHTSA testing, and because no information has arisen showing problems with the new head, the agency believes the new dummy head is completely suitable for use in the 3-year-old child dummy.

The NPRM proposed that NHTSA would continue testing add-on restraints with the present dummy head or the new head, at the manufacturer's option, for 3 years. The NPRM proposed that, after the 3-year period, NHTSA would test all add-on child restraints with dummies incorporating the new head assembly. The agency explained in the NPRM that it sought to have, eventually, only one head assembly for the 3-year-old-child dummy, to preclude inadvertent use of the current head assembly in a compliance test of a built-in restraint.

Ford requested that the agency permit indefinite use of the present dummy head, rather than limit such use to a 3-year period. Ford said that there is little risk that the wrong head would be mistakenly used, particularly if the new head is composed of aluminum or magnesium, materials unlike in appearance to the current (urethane) dummy head.

NHTSA disagrees with Ford that the agency's compliance procedures should permit the indefinite use of the present dummy head. Since the new head will be composed from fiberglass (and not the aluminum and magnesium materials Ford suggested) and is outwardly identical to the current head assembly, it is important that the agency reduce the likelihood that the present head could be inadvertently used in a compliance test of a built-in restraint system. Such errors would represent a needless waste of time and resources. With respect to add-on restraints, those that pass a Standard 213 compliance test when tested with a dummy incorporating the existing

head should also pass when tested with a dummy using the new head. Thus, there is no apparent advantage to retaining the old head beyond the 3 year period. Further, test dummy heads, on average, must be replaced after approximately 3 years due to the wear from testing and the aging of the rubbers and plastics in the head. Thus, the 3 year transition period before use of the new head assembly is mandated should not impose any burdens on the dummy users. Testing facilities could continue using the current head assemblies during the 3 year transition period and could purchase the new head assemblies when the current head assemblies must be replaced.

Ford and GM highlighted sections of the proposed regulatory language where typographical or editorial corrections were appropriate. NHTSA has adopted these suggestions. In addition, Ford asked the agency to make it clear that, during the 3 year period when optional use of either head is permitted, NHTSA's compliance testing would be conducted using the type of dummy head that the add-on child restraint manufacturer chose to use in certifying its restraint system. NHTSA does not object to using the same type of head, and has revised the text of S7.2 of Standard 213 to specify that the type of head used in compliance tests during the 3 year period is at the manufacturer's option.

Proposed specifications for the accelerometer

All comments relating to the proposed adoption of generic specifications for the accelerometer were supportive of the proposal. Ford suggested minor changes to the regulatory language to clarify specifications or correct typographical errors. The agency agrees with these recommendations, and has adopted the generic specifications proposed in the NPRM, as revised by Ford's suggested changes.

Effective date

The effective date for making these amendments to the CFR is 30 days from the date of publication.

Beginning 30 days after publication of the final rule, each 3-year-old-child test dummy NHTSA uses to test a built-in child restraint will be assembled with the new head assembly specified in §572.16(a)(1). The higher natural frequency response of the new head assembly will ensure that the head acceleration measurements taken during testing of built-in child restraints are accurate and reliable. Because of the need for accurate and reliable head acceleration measurements, the agency finds that this effective date of less than 180 days is in the public interest.

For add-on restraints, the NPRM proposed that manufacturers would have the option of specifying the use of the current or new head assembly in NHTSA compliance testing, beginning 30 days after publication of the final rule, "until three years after publication of a final rule." Permitting optional use of the proposed head assembly beginning 30 days after publication will not impose any burdens on any party, and will further the public interest by allowing manufacturers to gain experience with the new head assembly. Thus, NHTSA again finds good cause for such an effective date.

Although the NPRM did not identify the exact date 3 years after publication of a final rule from which use of the present head assembly in NHTSA's compliance tests will cease, such a date must be specified in Standard 213 so that all persons reading the standard can readily know how NHTSA conducts its testing. This final rule specifies this date as September 1, 1993. The agency has determined that this date is appropriate because it is approximately 3 years after the date of anticipated issuance of this final rule, and consistent with the date the NPRM proposed.

In consideration of the foregoing, NHTSA amends 49 CFR Parts 571 and 572 as follows:

S7.2 of §571.213 is revised to read as follows:

S7.2 *Three-year-old-child dummy.* A three-year-old-child dummy conforming to Subpart C of Part 572 of this chapter is used for testing a child restraint that is recommended by its manufacturer in accordance with S5.6 for use by children in a weight range that includes children weighing more than 20 pounds.

(a) *Built-in child restraints.* When a three-year-old-child test dummy is used for testing a built-in child restraint, the dummy shall be assembled with the head assembly specified in §572.16(a)(1).

(b) *Add-on child restraints.* Until September 1, 1993, when a three-year-old-child test dummy is used for testing an add-on child restraint, the dummy shall be assembled using, at the manufacturer's option, either head assembly specified in §572.16(a).

Effective September 1, 1993, when a three-year-old-child dummy is used for testing an add-on child restraint, the dummy shall be assembled with the head assembly specified in §572.16(a)(1).

* * * * *

PART 572—ANTHROPOMORPHIC TEST DUMMIES

1. The authority citation for Part 572 continues to read as follows:

Authority: 15 U.S.C. 1392, 1407; delegation of authority at 49 CFR 1.50.

Subpart C—3-Year-Old Child

2. Paragraphs (a) and (b) of section 572.16 are revised to read as follows:

§572.16 Head.

(a) The head consists of the assembly designated

as SA 103C 010 on drawing no. SA 103C 001, and conforms to either—

(1) each item specified on drawing SA 103C 002(B), sheet 8; or

(2) each item specified on drawing SA 103C 002, sheet 8.

(b) When the head is impacted by a test probe specified in §572.21(a)(1) at 7 fps, then the peak resultant acceleration measured at the location of the accelerometer mounted in the headform according to §572.21(b) is not less than 95g and not more than 118g.

(1) The recorded acceleration-time curve for this test is unimodal at or above the 50g level, and lies at or above that level for intervals:

(i) in the case of the head assembly specified in paragraph (a)(1) of this section, not less than 1.3 milliseconds and not more than 2.0 milliseconds;

(ii) in the case of the head assembly specified in paragraph (a)(2) of this section, not less than 2.0 milliseconds and not more than 3.0 milliseconds.

(2) The lateral acceleration vector does not exceed 7g.

* * * * *

Section 572.17(a) is revised to read as follows:

§572.17 Neck.

(a)(1) The neck for use with the head assembly described in §572.16(a)(1) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002(B), sheet 9.

(2) The neck for use with the head assembly described in §572.16(a)(2) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002, sheet 9.

* * * * *

Section 572.21 is amended by revising paragraphs (a), (b), and (c) to read as follows:

§572.21 Test conditions and instrumentation.

(a)(1) The test probe used for head and thoracic impact tests is a cylinder 3 inches in diameter, 13.8 inches long, and weighing 10 lbs., 6 ozs. Its impacting end has a flat right face that is rigid and that has an edge radius of 0.5 inches.

(2) The head and thorax assembly may be instrumented with a Type A or Type C accelerometer.

(i) Type A accelerometer is defined in drawing SA–572 S1.

(ii) Type C accelerometer is defined in drawing SA–572 S2.

(b) *Head Accelerometers.* Install one of the triaxial accelerometers specified in §572.21(a)(2) on a mounting block located on the horizontal transverse bulkhead as shown in the drawings subreferenced under assembly SA 103C 010 so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the head accelerometer reference point located at the intersection of a line connecting the longitudinal centerlines of the transfer pins in the side of the dummy head with the midsagittal plane of the dummy head.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with the midsagittal plane, with the seismic mass center located 0.2 inches dorsal to, and 0.1 inches inferior to the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane, perpendicular to the midsagittal plane, with the seismic mass center located 0.1 inches inferior, 0.4 inches to the right of, and 0.9 inches dorsal to the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 inches inferior to, 0.6 inches dorsal to, and 0.4 inches to the right of the head accelerometer reference point.

(iv) All seismic mass centers are positioned with ±0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with midsagittal planes, with the seismic mass center located from 0.2 to 0.47 inches dorsal to, from 0.01 inches inferior to 0.21 inches superior, and from 0.0 to 0.17 inches left of the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane, perpendicular to the midsagittal plane, with the seismic mass center located 0.1 to 0.13 inches inferior to, 0.17 to 0.4 inches to the right of, and 0.47 to 0.9 inches dorsal of the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 to 0.13 inches inferior to, 0.6 to 0.81 inches dorsal to, and from 0.17 inches left to 0.4 inches right of the head accelerometer reference point.

(c) *Thorax Accelerometers.* Install one of the triaxial accelerometers specified in §572.21(a)(2) on a mounting plate attached to the vertical transverse bulkhead shown in the drawing subreferenced under assembly No. SA 103C 030 in drawing SA 103C 001, so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the thorax accelerometer reference

point located in the midsagittal plane 3 inches above the top surface of the lumbar spine, and 0.3 inches dorsal to the accelerometer mounting plate surface.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with the seismic mass center located 0.2 inches to the left of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane, and perpendicular to the midsagittal plane, with the seismic mass center located 0.2 inches to the right of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.2 inches superior to, 0.5 inches to the right of, and 0.1 inches ventral to the thorax accelerometer reference points.

(iv) All seismic mass centers shall be positioned within ± 0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with the seismic mass center located from 0.2 inches left to 0.28 inches right, from 0.5 to 0.15 inches inferior to, and from 0.15 to 0.25 inches ventral of the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane and perpendicular to the midsagittal plane, with the seismic mass center located from 0.06 inches left to 0.2 inches right of, from 0.1 inches inferior to 0.24 inches superior, and 0.15 to 0.25 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.15 to 0.25 inches superior to, 0.28 to 0.5 inches to the right of, and from 0.1 inches ventral to 0.19 inches dorsal to the thorax accelerometer reference point.

Issued on July 20, 1990.

Jerry Ralph Curry
Administrator

55 FR 30465
July 26, 1990

PREAMBLE TO AN AMENDMENT TO PART 572

Side Impact Protection Anthropomorphic Test Dummy (Docket No. 88-07; Notice 3) RIN 2127-AA48

ACTION—Final rule.

SUMMARY: This notice establishes specifications for the side impact dummy that is to be used in the full-scale dynamic crash test specified under amendments to Standard No. 214, *Side Door Strength*, which appear elsewhere in today's *Federal Register*. The specifications for the side impact dummy are set forth in a new subpart F of Part 572, *Anthropomorphic Test Dummies*. The agency is specifying the side impact dummy (SID) that it proposed in January 1988. The agency notes that two alternative dummies, BioSID and EuroSID, are under development. The agency believes that these dummies may become available as regulatory test devices in the future. These dummies can measure the same injury criteria as SID, but also offer the advantage of measuring additional injury criteria. If ongoing studies demonstrate that one or both of these dummies compare satisfactorily to the SID, the agency will consider proposing such dummies as alternative devices in the future.

DATES: The amendments made by this rule to the Code of Federal Regulations are effective November 29, 1990. The new Standard No. 214 requirements which specify use of the side test dummy are phased in over a three-year period, beginning on September 1, 1993.

SUPPLEMENTARY INFORMATION:

Background

On January 27, 1988, NHTSA published in the *Federal Register* (53 FR 2239) a notice of proposed rulemaking (NPRM) to add procedures and performance requirements for a new dynamic test to Standard No. 214, *Side Door Strength*. In the proposed additional test, a passenger car must provide protection in a full-scale crash test in which the car (known as the "target" car) is struck in the side by a moving deformable barrier simulating another vehicle.

The proposed test procedure included placing anthropomorphic test dummies in the outboard front and rear seats of the target car to measure the potential for injuries to an occupant's thorax and pelvis. For the thorax, the proposed performance limit used an injury criterion known as the Thoracic Trauma Index (dummy) or TTI(d). This injury criterion is based on a combination of peak acceleration values measured in g's on the lower spine and the greater of the acceleration values of the upper and lower ribs of the test dummy. NHTSA requested comments on the appropriateness of a TTI(d) limit ranging from 80 to 115 g's. In addition, the notice requested comments on the appropriateness of limits, ranging from 130 to 190 g's, on the peak acceleration that the pelvis should experience during the impact.

In conjunction with the NPRM to amend Standard No. 214, NHTSA published a separate notice proposing specifications for the side impact test dummy (SID) to be used in the full-scale crash test. 53 FR 2254, January 27, 1988.

Elsewhere in today's *Federal Register*, NHTSA publishes a final rule adopting the dynamic test amendments to Standard No. 214.

This notice establishes specifications for SID. As described in detail later in this notice, the agency conducted a substantial number of tests to develop a test dummy that would be appropriate for use in the upgraded side impact standard. The SID adopted in this notice is based on the Part 572, Subpart B anthropomorphic test device that is used in existing occupant protection safety standards.

Summary of the Final Rule

The specifications for SID consist of a drawing package containing all of the technical details of the dummy parts and dummy assembly, and a set of master patterns for all molded and cast parts of the dummy. Those patterns make possible the rapid reproduction of those parts. In addition, there is a SID user's

manual containing disassembly, inspection, and assembly procedures; external dimensions and weight and a dummy drawing list. These drawings and specifications ensure that the dummies would vary little from each other in their construction. Performance criteria serve as calibration checks and further assure the uniformity of dummy assembly, construction, and instrumentation.

The dummy is instrumented with accelerometers for measurement of accelerations in the chest and pelvis during impacts. The rule specifies the manner and location of installation of the instrumentation to reduce variability in their measurements resulting from differences in location and mounting.

Drawings and specifications for the side impact test dummy are available for examination in the NHTSA Docket Section. Copies of those materials and the SID user's manual can be obtained from the Rowley-Scher Reprographics, Inc., 1111 14th Street, N.W., Washington, D.C. 20005, telephone (202) 628-6667 or 408-8789. In addition, patterns for all cast and molded parts are available on a loan basis from the NHTSA Office of Vehicle Safety Standards.

Description

The SID is identical to the existing Part 572, Subpart B test dummy used in Standard No. 208, with several exceptions. The thorax and pelvis have been redesigned to produce human-like acceleration responses in the lateral direction. Also, the dummy has provision to mount accelerometers for ribs, spine and pelvis; a shock absorber between the ribcage and the spine; and a hinge where the ribs attach to the spine. Further, to keep the design of the SID as simple as possible, the test device does not have articulating arms or shoulders. Instead, the mass of the arms has been incorporated into the mass of the thorax, and urethane foam 'stump' arms have been added for the appropriate biofidelity characteristics. The agency determined early in the development and testing of the SID that the presence of separate physical arms and shoulder structure introduces considerable response variability into the test results. In addition, the use of an articulating arm and shoulder sub-assembly might introduce unnecessary mechanical complications in the construction and assembly of the test dummy.

Biofidelity

In developing SID, NHTSA sought to develop a test dummy that would be an appropriate human surrogate for measuring injury risk in a side impact. The agency considered whether the human injury risk of the particular impact situation could be determined from measurement of responses obtained from SID, and whether those specific responses possess biofidelity of response with human beings. The term "biofidelity" refers to how well a test dummy duplicates the responses of a human being in an impact.

Based on cadaver tests, the agency developed two empirical criteria for measuring injury risk in side impacts: TTI(d) and pelvic acceleration. The bases for these injury criteria are fully discussed in the separate notice adding the dynamic test requirements to Standard No. 214. The agency believes that TTI(d), which is calculated using peak rib and spinal accelerations measured in g's, predicts the probability of differing levels of thoracic injury that a person would experience in a real-world crash. The agency similarly believes that pelvic acceleration predicts the probability of pelvic fracture that a person would experience in a real-world crash. The TTI(d) and pelvic g's injury criteria are based on a large data base containing information on 84 individual cadaver impacts. It should be noted that the two injury criteria do not address all types of injuries in a side impact. For example, they do not address head injuries or some types of abdominal injuries.

In order for SID, or any other test dummy, to be considered an appropriate human surrogate for measuring TTI(d) and pelvic acceleration in the side impact test procedure, the TTI(d) and pelvic acceleration measurements obtained from the dummy must be correlated to those which would be obtained if a human being were subjected to the same impact conditions.

During the development of the SID, NHTSA examined the biofidelity of the SID's thorax (rib/spine) and pelvic acceleration responses in simulated vehicle crash tests.

One primary set of data used by NHTSA in evaluating the biofidelity of the SID was from a series of tests sponsored by the Forschungsvereinigung Automobiltechnik (FAT), an association of German vehicle manufacturers (SAE paper 861877). In those tests, a moving barrier was attached to a sled buck and accelerated down a track so that it impacted the side of a subcompact automobile. A total of 35 three-point belt restrained cadavers and 5 SID test devices were used in this test series. The vehicles containing the cadaver test subjects were struck at speeds ranging from 40-60 kmh (25–37 mph) while the vehicles containing the SID were struck at 50 kmh (31 mph).

In analyzing the results of those tests, the agency compared the cumulative variance of the test dummy responses to the cumulative variance of the cadaver responses. The results, which were discussed in more detail on pages IIIB-8-9 of the Preliminary Regulatory Impact Analysis, indicated that the responses of the upper and lower ribs, the lower spine and the pelvis of the SID correspond well with the responses of the cadavers in similar impacts.

The agency also compared average peak acceleration values of cadavers and the SID in sled tests in which the occupant impacted a padded or rigid wall. These results showed that, for the rigid wall impact condition, the SID thorax and pelvis responses were greater than those of cadavers. This reflects the fact that the SID structure is made of steel and is, naturally, less compliant than the human skeletal structure. However, for the padded wall impact condition, which is more similar to the interior of a car, the SID responses were similar to the cadaver responses.

During the year before the NPRM was issued, NHTSA made a slight revision in the SID thorax design to accommodate a new rib damping material produced by United-McGill. The agency had learned that the damping material used in earlier versions of the SID was being phased out of production. While the proposed SID reflected the new damping material, the tests discussed above used SID dummies with the earlier damping material.

In an addendum to the PRIA, the agency reassessed biofidelity in light of the new damping material. Based on a comparison of peak acceleration values of the thorax in cadavers and the modified SID in 17 mph rigid wall sled tests and 23 mph padded wall sled tests, the agency concluded that the biofidelity of the proposed SID appeared to be better than the earlier SID design as the peak g's were closer to the baseline side impact cadaver data. As discussed in the PRIA, a comparison of the cumulative variance of the test dummy responses to the cumulative variance of the cadaver responses indicated that biofidelity was well within the range of acceptability.

The agency noted in the NPRM that although testing indicates that the SID experiences higher accelerations than a cadaver in a rigid wall impact, such a test environment is not typical of the occupant-to-door interior impacts experienced in side crashes. In tests with a padded structure, which will be more typical of the interior of a door, the SID responses are close to those of cadavers. This is true for both the earlier version of SID and the proposed SID.

In the process of developing the side impact test procedure, NHTSA also compared the force-time loading characteristics of the SID to cadavers in rigid and padded wall impact tests. The purpose of this comparison was to see whether the SID experiences a dynamic impact event in a way which is similar to the one in which a human being experiences such an event. In the NPRM, the agency stated that for rigid wall impacts at 23 mph, the SID thorax and pelvis responded with higher force levels compared to cadavers, but that for padded wall impact conditions, the responses were very similar. NHTSA recognizes, however, that even for the padded wall impacts, the SID experienced a somewhat higher peak force level than cadavers.

As discussed in the PRIA, the United-McGill damping material modifications made prior to issuance of the NPRM increased the force-time response and the impulse response.

NHTSA believes that examination of the impulse responses, which are shown in the FRIA, indicate that SID experiences the same basic dynamic event as a cadaver. For padded wall impacts, which are more similar to the conditions SID will experience in cars, the shape of the curves is generally similar. The duration of the event is similar for SID and cadavers, and the peak force occurs at essentially the same time. The agency's comparison of the acceleration responses of SID and cadavers indicates that the higher peak force experienced by SID does not translate into different acceleration responses. To the extent that the higher peak force is associated with a higher effective chest mass for SID than cadavers, the agency has, as discussed further below, studied the influence of the higher SID chest mass in selecting optimum countermeasures and determined that there is no significant effect.

Numerous commenters argued that SID lacks biofidelity in a number of areas. GM argued that SID is not a credible tool for predicting human response in a side impact because it lacks the following five essential human characteristics: proper chest deflection, proper chest mass, field relevant arm position, credible shoulder load path, and abdominal biofidelity and injury assessment capability.

GM stated that NHTSA's development of SID and a lateral thoracic injury criterion was based on the assumption that the acceleration and force responses of cadavers are sufficient to describe the risk of human thoracic injury in side impacts. That company argued that this is inaccurate, and that deflection is critical to assessing chest injury risk. GM stated that because SID was not designed with correct force versus deflection properties, it is fundamentally invalid as a human simulator.

According to GM, SID cannot reproduce human rib and spine accelerations for the relevant range of real world impact conditions. That commenter argued that the accelerations of the ribs and spine are necessarily dependent upon the compliance of the dummy components which interconnect them. GM argued that without human compliance properties, the acceleration responses cannot be human-like.

GM also argued that the SID thoracic rib mass is not representative of humans. That company stated that the rib mass of SID is about 10 times greater than the rib mass of Hybrid III. According to GM, the thorax of the SID experiences forces during impact that are due primarily to the inertial effects of its overly massive ribs. GM stated that the agency has indicated that the mass of the SID was selected to match the desired TTI values derived for specific test conditions.

That company argued that SID may produce accelerations comparable to the human for one single test condition, but its incorrect inertial properties will cause erroneous responses if the test conditions vary.

Ford commented that there are two major issues regarding SID—its structure, i.e., its stiffness and weight, and its performance, i.e., how human-like is its response. That company argued that the SID thorax is too heavy, too stiff, and does not provide a response which is adequately human-like. Ford argued that the excessive stiffness and greater mass, coupled with the acceleration-based injury criterion TTI(d), have the potential to lead to vehicle design countermeasures (primarily interior door padding) that are too stiff and could actually degrade occupant safety, especially that of the elderly.

Chrysler stated that test dummy biofidelity and Thorasic Trauma Index (TTI) have been the center of controversy since NHTSA's public meeting on side impact protection held in May 1986. (Here, TTI refers to the cadaver responses. It is different from TTI(d), which is the acceleration measurement on the dummy.) That company expressed concern that use of an inappropriate test dummy and injury criterion may result in vehicle designs which meet the requirements, but produce little real world benefits.

BMW argued that SID has inadequate biofidelity, which can lead to erroneous development of injury-reducing measures. According to that commenter, SID reacts more strongly to padding/damping material than do cadavers or real occupants. BMW stated that the rib mass of SID is too high. It argued that the mass of the "missing" arms should not be added to that of the ribs, because this does not represent a real occupant. BMW stated that neither from a biomechanical standpoint, nor from the consideration of a normal seating position, does this appear to be permissible. According to that company, the resulting excessive rib mass results in different inertia forces and effects than would be seen with humans. BMW argued that the inertia forces directly influence the required stiffness of damping materials and, in addition, the dummy kinematics will be influenced by the mass distribution, with additional potential to erroneously influence the development of protective measures.

BMW also expressed concern that force/deflection characteristics were not used in the development of the SID thorax. That company stated that these characteristics have great influence in side impacts, since here a direct interaction of the penetrating structure of the vehicle and the thorax area of the occupant occurs and is responsible for injuries. BMW also argued that peak rib and spine accelerations occur at different times during cadaver testing, but at the same time when SID is tested, which it considers to be another example of the inadequate biofidelity of SID.

A number of commenters cited the results of tests conducted according to procedures developed by the ISO to evaluate the biofidelity of side impact dummies, in support of the argument that SID lacks biofidelity. CCMC stated, based on its testing, that SID does not meet the requirements for 23 responses out of 36. This means that these SID responses differed from the required response by more than 20 percent. Of the remaining 13 responses, seven were exactly in the range prescribed by ISO, and the other six differed from the required ones by less than 20 percent. JAMA stated, based on its testing, that SID failed to meet all of the ISO requirements.

After considering the comments, NHTSA continues to believe that SID has adequate biofidelity. As indicated above, the agency believes that the relevant inquiry is whether SID can provide human-like measurements of the injury criteria specified in the side impact final rule, TTI(d) and pelvic acceleration, under conditions that are representative of real world side impact crashes.

Many commenter criticisms concerning SID biofidelity, including arguments that SID does not meet the ISO corridors for biofidelity, are irrelevant to SID's ability to provide human-like measurements of TTI(d) and pelvic acceleration. The ISO has adopted a very different approach than the agency in evaluating biofidelity. Based on a combination of pendulum, body-drop, and sled tests, it has defined biomechanical response corridors for the thorax, spine, pelvis, head, neck, chest displacement, shoulder and abdomen. In designing SID, NHTSA only sought to ensure biofidelity with respect to TTI(d) and pelvic acceleration. While the agency recognizes that biofidelity in other areas might increase dummy usefulness for purposes of research, it is unnecessary for purposes of a regulatory test device which is intended to measure potential for injury in specific body parts of an occupant under specified impact conditions.

With respect to BMW's assertion that peak rib and spine accelerations occur at different times during cadaver testing than when SID is tested. NHTSA's examination of test data indicates that, for a majority of test conditions, the peak rib and spine accelerations in the SID occurred at about the same time as for cadavers. However, precise agreement of the time of peak acceleration is not important. As long as peak acceleration values are similar, TTI(d) will be similar.

With respect to commenter concerns that the SID thorax is stiffer than that of humans, NHTSA notes that since SID was designed to measure acceleration-based injury criteria in vehicle environments, it was unnecessary for the agency to design SID with biomechanically correct thorax deflection or stiffness based on local area responses such as in pendulum tests.

The agency disagrees with the contention of several commenters that SID is an invalid human

surrogate because it was not designed with correct force versus deflection characteristics. First, as discussed at length in the main side impact notice, NHTSA believes that TTI(d), calculated using peak rib and spinal accelerations, adequately predicts the risk of thoracic injury. Thus, while the agency does not disagree that deflection might be relevant to chest injury risk under certain impact conditions, it does not accept the argument that deflection is critical. Second, NHTSA disagrees with the argument that because the SID thorax is stiffer than that of humans, the SID acceleration responses cannot be human-like. The agency believes that its biofidelity testing, discussed above, demonstrates that SID acceleration responses are close to those of humans, especially in test conditions which are representative of car interiors.

As discussed in the FRIA, analysis using the Department of Transportation side impact sensitivity model indicates that selection of optimum padding is not sensitive to variations in SID stiffness, and that paddings that optimize the SID response will also provide near optimum benefits for human occupants.

With respect to comments concerning the mass of the SID chest, NHTSA notes that, statically, the mass of 65.8 pounds is not significantly different from that of humans. The agency has found that the apparent effective thorax mass (dynamically) is about 18 percent higher than that of a 50th percentile male. As discussed in the FRIA, analysis using modelling indicates that SID's higher apparent effective thorax mass will not affect the selection of optimum padding.

The conclusions that the mass and stiffness of the SID chest will not significantly affect padding selection are supported by recent research comparing SID with two alternative side impact test dummies, EuroSID and BioSID. As part of this research, the agency conducted a series of tests to examine the effect of padding stiffness upon the injury hazard measurements of these dummies when subjected to a given test condition. All three dummies are known to have different thorax mass and thorax stiffness characteristics. Each of the dummies was exposed to a series of 20 mph lateral impacts into a rigid wall which was padded with three-inch thick foam padding of various stiffness. The padding stiffness varied from a very low value representative of a soft foam to nearly as stiff as the rigid wall. All three devices selected essentially the same optimum material, and all three dummies ranked the materials almost identically from softest to hardest. Thus, differences in chest mass and stiffness between the different dummies did not have any significant effect on padding selection.

The agency also notes that in recent tests conducted by MVMA, using Pontiac 6000's with and without padding, the SID and BioSID indicated similar padding effectiveness, i.e., percent reduction in TTI(d). This was in spite of the differences in chest mass and stiffness between the two dummies.

Since differences in thorax mass and stiffness of SID as compared to humans do not affect padding selection, the agency rejects the argument that the use of SID could lead to padding that is so stiff that it would increase injuries to the elderly or any other group of persons. NHTSA also notes that it is obvious that any padding that is added to a car to reduce TTI(d) as measured by SID would clearly be less stiff than the interior car door and, therefore, make a contribution to improving occupant safety for persons of all ages.

NHTSA is not persuaded by GM's concern that while SID may produce accelerations comparable to those for humans for one single type or level of exposure, its incorrect inertial properties will cause erroneous responses if the test conditions vary. As discussed above, SID does experience higher accelerations than a cadaver in a rigid wall impact. NHTSA believes it is important that SID experience human-like responses in the regulated environment. In car interior tests, and in tests with a padded structure, the SID responses are close to those of cadavers. Thus, in the regulated environment, SID testing will result in human-like responses. The SID/BioSID test results cited above also refute GM's claim, since differences in chest mass and stiffness between the two dummies did not lead to different evaluations of padding effectiveness.

The agency disagrees with GM's arguments that SID lacks credible shoulder load path or field relevant arm position. From early development tests, the agency found that an articulating arm and shoulder sub-assembly introduced test variability and mechanical reliability problems. In order to keep the design of SID as simple as possible, the agency designed it without articulating arms or shoulders. Instead, the mass of the arms and shoulders were built into the mass of the thorax, and urethane "stump" arms were added to attain the proper biofidelity characteristics.

As discussed in the FRIA, although the SID does not have an anatomically replicated shoulder structure and arms that can be articulated, there is strong evidence that the "stump" arm design appropriately incorporates the characteristics of the arm and shoulder into the thoracic structure, thus providing a credible shoulder load path. In NHTSA's rigid and padded wall sled tests, the shoulder area of the SID was a load bearing contact point as was the shoulder of the cadaver. There was a strong agreement between the SID and human specimen thorax responses. Also, pendulum tests conducted at 19 mph show reasonable force-time fidelity for the shoulder area of the SID.

GM's argument concerning arm position was based on a study of films indicating left arm position of drivers as they approached a stop sign at an inter-

section and as they started to leave the intersection. That company stated that while the driver used the arm rest 34.4 percent of the time in the open road, the armrest was used only 10.6 percent of the time at intersections. GM argued that because serious side impact injuries occur most frequently in intersection crashes, design improvements of the side interior should focus on the direct loading of the chest and abdomen. Direct loading of the chest and abdomen occurs when the arms are up. GM argued that SID's incorporation of the shoulder and arm into the chest structure replicates an arms down condition, which it believes is inappropriate based on observations of normal driving behavior.

The films utilized by GM were from an Insurance Institute for Highway Safety (IIHS) study concerning shoulder belt use and were taken at all-way stop sign intersections. As discussed in the FRIA, the agency examined the same films and had difficulty in determining arm position in many cases, as well as determining when a vehicle was entering an intersection. The films take a picture of the license plate and then of the occupants to determine belt position. The films generally do not follow the vehicle into the intersection unless a picture was not taken of the front license plate, which made it necessary to take a picture of the rear license plate. NHTSA found that about 40 percent of the drivers' arms were down, which is not significantly different from the number found by GM for drivers approaching an intersection. However, the agency could not determine the drivers' arm position for vehicles entering the intersection with any certainty, contrary to the GM claim.

Given the difficulties in determining the drivers' arm position when entering the intersection, NHTSA does not accept GM's claim that the films indicate that drivers' arms are down only about 10 percent of the time in intersections. In developing the side impact test procedure, NHTSA sought to specify conditions that are representative of a significant number of crashes. NHTSA believes that an arms-down approach is reasonable. As indicated above, the agency found that about 40 percent of the drivers' arms were down in the films cited by GM. Moreover, as discussed in the FRIA, the agency performed an informal survey at a Washington, D.C., intersection of 125 right front seat passengers and found that about 77 percent had their arms down. Finally, even if a driver's arms are up on the steering wheel, the thorax may be partially covered by the upper arm, depending on the length of the driver's arm and the position of the seat in relation to the steering wheel. In addition, the GM argument pertains only to drivers and not passengers. About 25 percent of side impact fatalities and injuries occur to passengers.

Volkswagen argued that shortfalls of SID with respect to biofidelity are demonstrated by full scale crash tests conducted by the Motor Vehicle Manufacturers Association (MVMA) with redundant accelerometers. According to that company, the MVMA data show differences as high as 32 percent in maximum acceleration readings from accelerometers placed next to each other. Volkswagen argued that these differences must be addressed and resolved if the proposed standard is to meet the test of objectivity and reproducibility required of a safety standard.

NHTSA examined the MVMA test data to assess Volkswagen's concern. The agency notes that differences as high as 32 percent occur in certain cars well after the primary peak acceleration has been recorded. For the peak acceleration values which are used in calculating TTI(d), differences between primary and redundant acceleration data are within a normal range of variability. Since the primary and redundant accelerometers are located at slightly different spots, some differences should be expected. The agency also notes that redundant accelerometers are not used in calculating TTI(d).

Durability and Reliability

In the NPRM, NHTSA explained that it had gained considerable experience regarding the SID's durability and reliability from 20 full scale production vehicle tests conducted for the agency by the Transportation Research Center (TRC) of Ohio and from 16 modified 1985 Ford LTD tests, also conducted by TRC of Ohio for MVMA (Society of Automotive Engineers (SAE) paper 871115). These full scale vehicle tests were conducted with the SID unrestrained and simulated typical two vehicle perpendicular impacts, using the MDB at a speed of 33.5 mph. In NHTSA's tests, the relative velocity of the SID and the inner door surface at contact ranged up to 25 mph, based on analysis of the door and SID accelerometer responses.

NHTSA stated in the NPRM that these tests, in combination with rigid wall sled tests, cover what is considered to be the range of impact environments to be encountered by the SID when it is used by vehicle manufacturers in upgrading the side impact performance of their automobiles. The agency stated that at one end of the scale, the rigid wall sled tests conducted at 23 mph are considered to be the most severe of impact environments. At the other end of the scale, the modified 1985 Ford LTD tests conducted by MVMA represent what is considered to be the least severe test condition (with respect to the thorax and pelvis).

While NHTSA's test program covering the first 19 production vehicles was underway, NHTSA identified several changes that would increase the durability of the SID. Those changes, which were incorporated into the dummy and discussed in the NPRM, included: (1) replacing the leather rib hinge of the SID with a rubber impregnated transmission belt to eliminate a

fatigue failure problem, (2) adding a universal joint to the end of the thorax shock absorber to prevent shock absorber piston rod bending as the chest rotated about the spine box, and (3) building plastic hinges into the femurs to stop the breakage of the aluminum knee castings caused by lower leg bending movement during side structure deformation. Since changing the rib hinges could potentially affect the acceleration measurements made with the SID, the agency studied the influence of the new hinge material on thoracic response. The agency determined that only insignificant differences in responses occurred.

The agency has also done considerable work to overcome two other durability problems that developed during the first 19 production vehicle tests. Those two problems involved the delamination of the damping material from the ribs of the SID thorax and the presence of approximately one-half inch of permanent deflection in the rib cage following severe impacts. Delamination of the rib damping material could allow mechanically generated signals to interfere with rib acceleration signals and permanent deflection set within the rib cage could significantly alter the geometry of the SID so that errors could occur in the thoracic responses. NHTSA has studied the influence of both of these failure modes on the production vehicle test results and found that the thoracic responses were not significantly altered by either damping material delamination or the permanent set of the ribs. However, to reduce the possibility of any adverse effects, the agency has developed a new method of attaching the damping material to both inner and outer surfaces of the ribs to reduce delamination. Further, NHTSA has adopted the United-McGill damping material used in the Hybrid III dummy. In addition, the SID drawings package shows the dimensions and configuration of the ribs and the SID user's manual specifies a tolerance for the allowable deviation from the specified rib configuration. Together, these will ensure that the test dummy's ribs do not experience excessive permanent deflection after repeated use.

In the PRIA addendum, NHTSA stated that it had determined that the 23 mph rigid wall condition is too severe for testing durability, with TTI(d)'s in excess of 200, far exceeding the full scale production car range. For the proposed SID, incorporating the United-McGill damping material, a 17 mph rigid wall test was selected for durability testing. This sled test condition corresponds more closely with the upper end of the TTI(d) results that occur in full scale crash tests. In a number of tests discussed in the PRIA addendum, no damping material delamination occurred, and permanent rib bending did not exceed .125 inches.

The agency stated in the NPRM that, overall, it expects the durability of the SID to equal or exceed that of the Hybrid III test dummy. One of the primary reasons for this expectation is that the SID is based on the existing Part 572 Subpart B test dummy, which is durable enough to be used in 70 full scale, unretrained, 30 mph frontal crash tests.

As discussed in the FRIA, with the exception of the ribs and pelvis, which are anticipated to last eight crash tests before needing major replacement parts, NHTSA anticipates that the number of SID full scale side impact crash applications will exceed at least 30 tests without needing major repairs.

NHTSA conducted eight additional full scale tests after issuance of the NPRM. In its testing with the SID, the agency did not experience any problems relating to durability. Further, MVMA and Ford did not note any problems relating to durability in their testing with SID.

Mercedes-Benz commented that a weak-point built into the SID upper thigh, which it assumed to be for protection of the dummy, required repair after each test. It recommended installation of a shear-pin at this connection to prevent damage to other dummy components. That company also suggested that installation of a six-channel force transducer at the thigh be considered in lieu of a shear pin-in order to allow measurement of the movements about this joint.

NHTSA notes that its experience with the SID in testing has been different from that of Mercedes. When an earlier version of SID had a shear pin in its leg, the legs were damaged in tests. The agency revised the design in 1984 and, since then, has not experienced any leg durability problems. Since NHTSA has not specified any leg injury criterion, it has not included any moment measurement in the leg joint.

Reliability

Reliability is closely related to durability in that both affect the ability of the tester to achieve valid and repeatable test results. NHTSA considers reliability to be a measure of the ability of the dummy to achieve valid test results when the dummy is properly calibrated and in good working order. NHTSA considers the term durability, on the other hand, to mean the longer term ability of the dummy to remain in calibration, coupled with the ability of the individual dummy components to resist failure.

The agency explained in the NPRM that, for 20 production vehicle tests, there were a total of 160 primary channels of test data collected. In those tests, there were only 3 cases of lost data used for TTI(d) computations and 5 cases of data missing in pelvis acceleration readings. These test results indicated an overall SID data acquisition reliability of 93 percent for TTI(d) and a reliability of 88 percent with respect to pelvis acceleration. The reliability of SID in the additional eight tests conducted after issuance of the NPRM remained consistent.

In reviewing the results of the NHTSA and MVMA full scale tests, the agency concludes that SID is just as reliable as the Hybrid III dummy or the Part 572, Subpart B dummy.

Repeatability and Reproducibility

As discussed in the NPRM, NHTSA has carefully studied the repeatability and reproducibility of the SID using two methods. The control of the variation of dummy responses for the same device (called repeatability) and among different SID devices (called reproducibility) has been a primary goal of the agency during development of the side impact test dummy.

The agency has used a number of methods to evaluate the repeatability and reproducibility of the SID. In work done for the agency by Calspan, the agency used a statistically based approach called the Normalized Integrated Squared Error Method in which the amplitude, phase, and shape of the deviations of each individual acceleration-time response curve of the SID is compared to the mean value for all the curves (SAE Paper 831624). The second method used by the agency involved comparing the coefficient of variation for a sample of pendulum data and 23 mph sled test data (Safety Research Laboratory (SRL)–102).

In its study, Calspan established, based on its engineering judgment, a 6 percent range of acceptable variance for repeatability and an 8 percent range of acceptability for reproducibility for the phase, amplitude, and shape of the response acceleration-time curves (SAE Paper 831624). Calspan evaluated a group of six SIDs in a series of 14 and 20 fps pendulum impacts. The results obtained in those tests are representative of the SID test devices used in the early development phases of the agency's side impact program. The results showed that the repeatability and reproducibility of the test dummies were well within the two ranges of variability.

NHTSA's Vehicle Research and Test Center conducted a series of 14 fps pendulum impacts and 23 mph sled tests with some of the SID dummies being used in the 19 full scale production vehicle test program. The coefficients of variance for the 14 fps pendulum qualification tests conducted on two of the test dummies ranged from 4.8 percent to 6.9 percent for one test dummy and 3.8 percent to 4.1 percent for the other, well within the range of acceptability.

The agency also examined the repeatability and reproducibility of the test dummies in 23 mph sled tests. Those tests showed that, for the thorax, spine, and pelvis responses, the repeatability is very high, with coefficient of variation values of 2.9 percent maximum for the ribs, 7.7 percent for the lower spine and 1.7 percent for the pelvis. With respect to reproducibility, the coefficients of variance values for the same three responses among the three SIDs tested were maximums of 2.4, 6.2, and 2.5 percent, respectively. By comparison, the Hybrid III repeatability coefficient of variation values ranged from 2.7 percent to 6.2 percent while reproducibility coefficient of variation values varied from 3.4 percent to 5.2 percent.

In the PRIA addendum, the agency presented repeatability/reproducibility data, derived from sled tests, for SID dummies incorporating the United-McGill damping material. The data indicated that the repeatability of all the proposed SID responses was as good, if not better, than the earlier SID. Except for the pelvis of the proposed SID at 17 mph rigid wall, the reproducibility of the proposed SID appeared to be about the same as the earlier SID. While pelvic reproducibility was not as good for the 17 mph rigid wall condition, with a coefficient of variation of 13 percent, pelvic reproducibility was excellent for the 23 mph padded wall condition, with a coefficient of variation of only 2 percent. Since the agency believes that a padded wall condition is more representative of a car interior, the agency considered the overall reproducibility of the pelvis to be acceptable.

Several commenters argued, notwithstanding the analysis presented in the NPRM and PRIA, that SID lacks repeatability and reproducibility. JAMA argued that its data from five impactor tests indicated that SID lacks repeatability. According to that organization, the coefficient of variation for the SID upper spine acceleration was 10.1 percent. JAMA also argued that SID lacks reproducibility, even for dummies produced by the same manufacturer. According to that commenter, data from five impactor tests conducted on a pair of SID dummies resulted in a coefficient of variation of 17.7 percent for lower rib acceleration.

Nissan commented that reproducibility even among dummies from the same manufacturer proved unacceptably poor in its tests, which it said were carried out in accordance with the proposed NHTSA procedures. That company stated that it is not satisfied that the data presented by NHTSA has laid to rest the issue of dummy reproducibility, and argued that further testing by the agency is warranted.

CCMC commented that wide calibration tolerances for SID, such as the proposed tolerance of ± 20 percent for the pelvis acceleration, are too great to ensure reproducible test results. That commenter argued that under otherwise identical test conditions, widely deviating results, with a range of 40 g to 60 g, can be expected with dummies which perform at the upper or lower limit.

Volkswagen expressed similar concerns to those of CCMC and recommended that the regulation specify that the existence of a manufacturer's development or certification test data at a specific dummy calibration require evidence of conflicting data at the same calibration before a noncompliance investigation can

begin. Volkswagen stated that "another result of the physical limitations of the material used to construct the SID is the spread of certain calibration corridors. Wide calibration corridors may provide unintended and unnecessary risks of non-compliance for manufacturers who performed good faith tests indicating compliance with the standard. If certification testing and compliance testing are coincidently conducted with dummies which fall into opposite ends of the allowable calibration spectrum, conflicting results are likely to occur. For example, the calibration tolerances of ± 20 percent for the pelvis accelerations are too great to assure reproducible test results. Under otherwise identical test conditions, widely deviating results with a range of 40–60 g's are expected with dummies which perform at the upper or lower limit. This tolerance is not acceptable for a regulatory compliance test device."

Volvo also expressed concern about the proposed calibration tolerance bands. That company noted that the agency proposed tolerance bands of ± 11 percent for rib acceleration, ± 20 percent for pelvis acceleration, and ± 19 percent for lower spinal acceleration. Volvo stated that for most other dummies used in development and compliance testing, including three Part 572 dummies, the accepted calibration tolerance bands are approximately ± 10 percent for measurements from which injury criteria are calculated. That commenter stated that it is not acceptable that tolerance bands as wide as ± 20 percent exist on measurements used in the calculation of TTI and pelvic acceleration.

Toyota argued, based on calibration tests of five SID dummies produced by two manufacturers, that repeatability was poor even for one dummy, and that there were marked differences between individual dummies made by the same manufacturer as well as differences between the two manufacturers' dummies. That company also argued that the proposed calibration tolerances are so large as to make objective testing impossible. Toyota argued that if it is too difficult to narrow the measurement range, it will be necessary to have the means to compensate for the test results by employing the calibration results.

Toyota also stated that it believes that if there is to be satisfactory repeatability in full scale testing, the differences in the impact response characteristics of the individual dummy parts must be minimized. Toyota stated that it discovered great differences in the force-crush characteristics of the arm foam of the five SID dummies, and argued that the agency should set clear SID component performance parameters for critical SID components, i.e., arm foam, ribs, rib wrap, etc.

After considering the comments, NHTSA continues to believe that SID has adequate repeatability and reproducibility. The agency notes that commenter concerns about SID repeatability/reproducibility were for the most part based either on the results of calibration tests conducted according to the proposal, or on the proposed calibration tolerance bands.

In addressing those comments, the agency believes it appropriate to first discuss the purpose of the proposed calibration tests. Before a test dummy can be used in a vehicle crash test, it must be examined to determine whether it conforms to all of the specifications set out in the blueprints for the dummy. In addition, the dummy must be carefully examined to make sure that it has been correctly assembled. Finally, the test dummy must pass a series of calibration tests, which are also referred to as qualification tests. The purpose of a qualification test is to measure the performance of the test dummy in a well-controlled laboratory impact test to determine whether the test dummy's responses are within specifications and thus the test dummy will provide objective results.

The agency proposed two calibration tests for the side impact test dummy. The first is a 14 fps pendulum impact to the center of the side of the thorax on the side to be struck. The purpose of that test is to measure the response of the upper and lower rib and the lower spine. The proposed qualification limits in those tests were that the upper rib must experience an acceleration that is not less than 37 g's and not more than 46 g's, the lower rib must experience between 37 and 46 g's and the lower spine 15 to 22 g's. The other test involves a 14 fps pendulum impact to the pelvis to measure the pelvic responses. The proposed limits were that the acceleration measured in the pelvis shall be not less than 40 g's and not more than 60 g's. In addition, the acceleration-time curve must be unimodal and lie at or above the + 20 g level for not less than 3 milliseconds and not more than 7 milliseconds.

While NHTSA has considered various pendulum tests, including calibration tests, in evaluating repeatability/reproducibility, it does not consider them to be the most reliable tests for such evaluation. The energy imparted into a dummy in calibration testing is much lower than the energy that the dummy will receive in full scale testing. The dummy is a device made up of many mechanical components and built in frictions which will vary from dummy to dummy. This will affect how the dummies respond in the low energy calibration tests to a far greater degree than the high energy of full scale testing. This produces higher variance in low speed calibration tests than will be experienced in higher severity full scale tests. This is illustrated by the fact that in a repeatability test series conducted by NHTSA under its New Car Assessment Program (for frontal protection, using a different dummy), differences in dummy calibration results had "no . . . correlation to dummy response results in the vehicle crash event." SAE paper 840201, February 1984. NHTSA believes that the proposed calibration tests for SID, with their present spread, ensure that the dummies being delivered are built alike and that they will give like responses during full scale tests.

The agency believes that the best tests for evaluating dummy repeatability are sled tests at a speed equivalent to full scale test inner door impact speeds. Sled tests can be better than vehicle tests for this purpose because sled tests eliminate full scale vehicle test variability. The results of such a series of sled tests, cited above, indicated that SID has good repeatability/reproducibility.

NHTSA also notes that full scale side impact test data, discussed in the main side impact notice indicate good repeatability/reproducibility. Since dummy repeatability/reproducibility is reflected in full scale test results, the full scale data support the conclusion that SID has good repeatability/reproducibility.

Since sled test data and full scale crash test data indicate that SID has good repeatability/reproducibility, NHTSA concludes that the inherently greater variability found in calibration tests is not a problem. The agency similarly concludes that the proposed calibration tolerance bands will not result in poor repeatability/reproducibility.

With respect to Toyota's claim that additional component performance parameters should be established for critical SID components, NHTSA notes that extensive specifications have already been provided for the SID, as well as qualification tests. The agency does not believe that company has demonstrated that additional specifications are needed to ensure repeatability/reproducibility in the side impact full scale test.

Qualification Tests

NHTSA notes that the proposed qualification tests are discussed at some length in the preceding section on repeatability/reproducibility, and that discussion will not be repeated.

NHTSA explained in the NPRM that, with one exception, both proposed qualification tests utilize readily available compliance test equipment instrumentation and procedures that are already used in qualification testing of other test dummies. The one exception is the use of a Finite Impulse Response (FIR) filter to process the acceleration data measured in the test. The agency proposed the use of the FIR filtering methodology to process acceleration signals, rather than the standard SAE practice, since the FIR filtering technique was used with the cadaver impact data and with the sled and vehicle test data. Some additional steps are needed in handling the thorax response data. A special Fortran software package, called FIR100, developed by the agency is necessary to process the data (See Docket No. 79-04-N02-018). Based on its experience, NHTSA does not anticipate that crash data processing would be significantly affected by requiring the use of the FIR filter by the manufacturers and compliance test laboratories.

The agency noted that the two specified qualification tests for the SID require less labor and are less expensive compared to the tests used with the Part 572 Subpart B and and the Hybrid III in a Standard No. 208 compliance test. The Part 572, Subpart B test dummy must pass 10 qualification tests and the Hybrid III must pass 9 tests. Although the SID has significantly fewer qualification requirements, hence lower labor costs per test, some of that benefit may be offset, for example, in replacing ribs or sections of ribs if the qualification corridors are not met. The SID chest appears to be more complicated than the Hybrid III thorax and could be more labor intensive if repairs are needed.

As discussed above, a number of commenters argued that the proposed calibration tolerances for SID are too wide to ensure repeatable test results. The concerns about repeatability are addressed above. NHTSA is not narrowing the calibration limits, since to do so would make it more difficult to calibrate the dummies. The calibration limits are based on consideration of a large amount of test data.

Toyota stated that it believes the 4.27 m/s speed in the calibration test, compared to the 10 to 12 m/s secondary collision speed in the full scale test, is too low. It argued that the speed must be raised if dummy performance is to be assured in full scale testing.

NHTSA notes that the calibration tests are not the primary means for ensuring repeatability/reproducibility in full scale testing. The primary means involve detailed specification of all dummy parts. The calibration tests serve as a final check on uniformity of construction, assembly and instrumentation. The tests also help indicate if a dummy has been damaged in a prior test. NHTSA believes that the proposed speeds are adequate for these purposes. If higher speeds were selected, the calibration tests themselves could potentially result in damage to the dummy, because of the concentrated loading in such tests.

Toyota stated that it conducted calibration tests on five SID dummies, three produced by ARL and two produced by Humanoid, and was not able to calibrate them. It stated that this problem can be attributed to variations in dummy manufacture, and expressed concern that it and other auto manufacturers could be forced to spend time and money on dummy adjustment, procurement of components and retesting before any SID could be used in actual certification testing.

Nissan stated that it conducted calibration tests using four assemblies of SID, and none of the assemblies satisfied the proposed calibration requirements.

When a new SID dummy is purchased, the purchaser should check it carefully to ensure that it meets the specifications established by NHTSA. Also, adjustments to the dummy may be necessary to bring it within the specified calibration bands.

The agency is aware that some SID dummies have been delivered with materials that do not meet specifications. For example, inspections of dummies by NHTSA staff have revealed such things as rib hinges mounted with the wrong orientation, rib damping material extending too far along the rib at the spine end, and rib wrap and arm parts made from the wrong foam. NHTSA considers it unfortunate that these types of manufacturing deficiencies sometimes occur. Some of the deficiencies may be attributable to start-up problems in producing a new dummy, and are not different from the problems experienced with other new dummies. However, dummy purchasers can resolve these sorts of problems by careful inspection of the dummies and by working with the dummy manufacturer. By taking these actions, and making appropriate dummy adjustments, users can bring their dummies within the specified calibration bands.

Temperature Sensitivity

As discussed in the NPRM, the agency developed the side impact test procedure, and the application of the SID dummy, around a 66° F to 78° F interior occupant temperature range, the same as required for the Part 572, Subpart B dummy used in Standard No. 208 tests. The similarity in construction of the chests of the SID, Part 572, Subpart B, and Hybrid III have made the agency particularly aware of response variations due to changes in temperature and of the importance of a practicable test temperature range for side impact compliance tests.

The test procedure specifies that the SID be placed in a controlled temperature environment for at least four hours within a 66–78° F temperature range prior to each crash test. In addition, the SID is to be maintained within this temperature range during the crash test. NHTSA has found in its crash testing of production vehicles that it is possible to maintain the temperature of the test dummy within the required range prior to the test by using a portable heating or air conditioning unit, as necessary. In cases of extremely low or high temperatures, the agency has found that the use of a portable garage can provide a controlled ambient temperature of approximately 72° F.

At the time of the NPRM, the agency did not have temperature sensitivity data. Since that time, the agency has conducted a test series and the temperature sensitivity of the SID appears to be superior to that of Hybrid III and comparable to the Part 572 Subpart B dummy. The FRIA presents data comparing SID sensitivity with the Part 572, Subpart B and the Hybrid III dummy.

FIR Filter

The FIR filter is used in the side impact test procedure to select rib, spine and pelvis responses from acceleration signals.

Ford commented that FIR filter differences need to be resolved. That company stated that, for use in compliance testing, the FIR filter procedure must be specified in detail. Ford stated that, in particular, the agency must specify the type of SAE Class 180 prefilter that must be used (i.e., Butterworth, Chebyshev, etc.), how bias is handled, subsample rate and the digital software coding. That company stated that it believes the present FIR filter specification could lead to significant differences in test results between different testing laboratories.

In light of Ford's concerns about possible variability, NHTSA is specifying use of its own computer program called FIR100. See Docket No. 79-04, Notice 2, item 18.

Alternative Dummies

As part of its side impact rulemaking, NHTSA has considered two alternative dummies to SID, EuroSID and BioSID. As discussed in the NPRM, the EuroSID dummy was developed by a group of European research organizations under the auspices of the European Experimental Vehicles Committee (EEVC). Subsequent to issuance of the NPRM, GM developed the BioSID dummy, in cooperation with the Society of Automotive Engineers.

NHTSA tested a prototype or pre-production EuroSID dummy and concluded that it was well designed and durable for the conditions tested, possessed "good" repeatability, and could be used to assess potential countermeaures. The biofidelity was equivalent to the SID in both pendulum and sled tests and was essentially equivalent to the SID in terms of acceleration responses, wall loading, and TTI(d) computation.

One of the advantages of the EuroSID is that it measures chest deflection and velocity and can therefore be used to measure Viscous Injury Criterion (V*C) as well as TTI(d). (A discussion of alternative thoracic injury criteria, including V*C, is provided in the main side impact notice.)

One of the problems discovered in NHTSA's EuroSID sled tests was that the ribs were bottoming out, which may have invalidated the V*C measurements being made. This condition was characterized by a flat spot on the displacement-time history curve, while the acceleration-time history curve showed an increase with time until the peak g was reached. Although considerable attempts were made to correlate V*C and TTI(d), the deflection data collected continued to be questionable. The EuroSID specifications also have changed since NHTSA tested the prototype. In view of this, NHTSA returned one of two EuroSIDs so that it could be retrofitted in accordance with its latest specifications.

In 1988, MVMA conducted a full scale crash test series using the prototype EuroSID dummy in a variety of test configurations: (1) NHTSA test procedure and the EuroSID dummy, (2) NHTSA test procedure with

EEVC barrier face and the EuroSID dummy, and (3) the European test procedure. In the MVMA data set, the same rib deflection bottoming phenomenon was observed, calling into question the validity of the V*C measures that were made. TTI(d) measurements were also taken in that test program. See Docket No. 88-06-N01-089.

NHTSA recently conducted a series of 20 mph sled tests comparing the ability of the retrofitted EuroSID, SID and BioSID to discriminate between padding types using the TTI(d). The results indicate that as an acceleration based tool, the EuroSID is comparable to the other side impact dummies.

The BioSID dummy was designed to conform to the ISO biofidelity corridors and can measure rib deflection for the computation of V*C. NHTSA purchased two pre-production BioSIDs, and as discussed above, has conducted a 20 mph sled test series to compare the ability of BioSID and the other two dummies to discriminate between different types of padding material using the TTI(d). As discussed in the FRIA, BioSID's performance was equivalent to the SID and the EuroSID in selecting the optimum padding using TTI(d) as the injury criterion. NHTSA has initiated an independent test program to further study the BioSID and evaluate its suitability as an alternative side impact dummy (e.g., sled tests and full scale crash tests). In addition, MVMA has recently completed a full scale crash test program at the GM Proving Grounds using the BioSID and the SID to establish full scale crash comparability between the two test devices.

NHTSA recognizes that BioSID and EuroSID have potential advantages over SID to the extent that they can measure V*C or other compression-based injury criteria in addition to TTI(d). Specification of EuroSID as an alternate test device could also promote international harmonization.

However, the agency does not believe that these potential advantages should lead to a delay in this rulemaking for further consideration of alternate dummies. NHTSA believes that TTI(d) is a reliable predictor for thoracic injury and that SID is fully developed and validated. Since SID is ready now, and a final rule specifying SID can result in significant safety benefits, the agency believes it is appropriate to now go to a final rule using the SID.

Assuming that NHTSA's review of the BioSID is satisfactory, the agency intends to propose the use of the BioSID as an alternate test device. Europe is continuing to work on the EuroSID. If the agency obtains data showing that EuroSID compares satisfactorily with SID, it may also propose that dummy as an alternate test device.

Drawing Package

As indicated earlier in this notice, the specifications for SID consist of a drawing package containing all of the technical details of the dummy parts and dummy assembly, and a set of master patterns for all molded and cast parts of the dummy. There is also a SID user's manual containing disassembly, inspection, and assembly procedures; external dimensions and weight; and a dummy drawing list. The drawings and specifications are provided to ensure that the dummies will not significantly vary in their construction.

41 PART 572—[AMENDED]

In consideration of the foregoing, 49 CFR Part 572 is amended as follows:

A new Subpart F, consisting of sections 572.40 through 572.44, is added to read as follows:

Subpart F
Side Impact Dummy 50th Percentile Male.

Sec.

572.40 Incorporated materials.
572.41 General description.
572.42 Thorax.
572.43 Lumbar spine and pelvis.
572.44 Test conditions and instrumentation.

Subpart F—Side Impact Dummy 50th Percentile Male.

§ 572.40 Incorporated materials.

(a) The drawings, specifications, and computer program referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. These materials are thereby made part of this regulation. The Director of the *Federal Register* has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the *Federal Register* and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader, the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the *Code of Federal Regulations*.

(b) The materials incorporated in this part by reference are available for examination in the general reference section of Docket 79-04, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street, S.W., Washington, D.C. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1111 14th Street, N W., Washington, D.C. 20005, telephone (202) 628-6667 or 408-8789.

§ 572.41 General description.

(a) The dummy consists of component parts and component assemblies (SA-SID-M001A) which are described in approximately 250 drawings and specifi-

cations that are set forth in Part 572.5(a) of this Chapter with the following changes and additions which are described in approximately 85 drawings and specifications:

(1) The head assembly consists of the assembly specified in Subpart B (§ 572.6(a)) and conforms to each of the drawings subtended under drawing SA 150 M 010 and drawings specified in SA SID M 010 of this subpart.

(2) The neck assembly consists of the assembly specified in Subpart B (§ 572.7(a)) and conforms to each of the drawings subtended under drawing SA 150 M 020 and drawings shown in SA-SID-M010.

(3) The thorax assembly consists of the assembly shown as number SID-053 and conforms to each applicable drawing subtended by number SA SID M 030.

(4) The lumbar spine consists of the assembly specified in Subpart B (§ 572.9(a)) and conforms to drawing SA 150 M 050 and drawings subtended by SA SID M 050 specified by this part.

(5) The abdomen and pelvis consist of the assembly specified in Subpart B (§ 572.9) and conform to the drawings subtended by SA 150 M 060 and drawings subtended by SA SID M 060 specified by this Subpart.

(6) The lower limbs consist of the assemblies specified in Subpart B (§ 572.10) shown as SA 150 M 080 and SA 150 M 081 in Figure 1 and SA SID M 080 and SA SID M 081 and conform to the drawings subtended by those numbers.

(b) The structural properties of the dummy are such that the dummy conforms to the requirements of this subpart in every respect both before and after being used in vehicle tests specified in Standard No. 214 (Part 571.214 of this Chapter).

(c) Disassembly, inspection, and assembly procedures; external dimensions and weight; and a dummy drawing list are set forth in the Side Impact Dummy (SID) User's Manual, dated July 1990.

§ 572.42 Thorax.

(a) When the thorax of a completely assembled dummy (SA-SID-M001A), appropriately assembled for right or left side impact, is impacted by a test probe conforming to § 572.44(a) at 14 fps in accordance with paragraph (b) of this section, the peak accelerations at the location of the accelerometers mounted on the thorax in accordance with § 572.44(b) shall be:

1. for the accelerometer at the top of the Rib Bar on the struck side (LUR or RUR) not less than 37 g's and not more than 46 g's.

2. for the accelerometer at the bottom of the Rib Bar on the struck side (LLR or RLR) not less than 37 g's and not more than 46 g's.

3. for the lower thoracic spine (T12) not less than 15 g's and not more than 22 g's.

(b) *Test Procedure* (1) Adjust the dummy legs as specified in § 572.44(f). Seat the dummy on a seating surface as specified in § 572.44(h) with the limbs extended horizontally forward.

(2) Place the longitudinal centerline of the test probe at the lateral side of the chest at the intersection of the centerlines of the third rib and the Rib Bar on the desired side of impact. This is the left side if the dummy is to be used on the driver's side of the vehicle and the right side if the dummy is to be used on the passenger side of the vehicle. The probe's centerline is perpendicular to thorax's midsagittal plane.

(3) Align the test probe so that its longitudinal centerline coincides with the line formed by the intersection of the transverse and frontal planes perpendicular to the chest's midsagittal plane passing through the designated impact point.

(4) Position the dummy as specified in § 572.44(h), so that the thorax's midsagittal plane and tangential plane to the Hinge Mounting Block (Drawing SID-034) are vertical.

(5) Impact the thorax with the test probe so that at the moment of impact at the designated impact point, the probe's longitudinal centerline falls within 2 degrees of a horizontal line perpendicular to the dummy's midsagittal plane and passing through the designated impact point.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical or rotational movement.

(7) Allow a time period of at least 20 minutes between successive tests of the chest.

§ 572.43 Lumbar spine and pelvis.

(a) When the pelvis of a fully assembled dummy (SA-SID-M001A) is impacted laterally by a test probe conforming to § 572.44(a) at 14 fps in accordance with paragraph (b) of this section, the peak acceleration at the location of the accelerometer mounted in the pelvis cavity in accordance with §572.44(c) shall be not less than 40 g and not more than 60 g. The acceleration-time curve for the test shall be unimodal and shall lie at or above the +20g level for an interval not less than 3 milliseconds and not more than 7 milliseconds.

(b) *Test Procedure.* (1) Adjust the dummy legs as specified in § 572.44(f). Seat the dummy on a seating surface as specified in § 572.44(h) with the limbs extended horizontally forward.

(2) Place the longitudinal centerline of the test probe at the lateral side of the pelvis at a point 3.9 inches vertical from the seating surface and 4.8 inches ventral to a transverse vertical plane which is tangent to the back of the dummy's buttocks.

(3) Align the test probe so that at impact its longitudinal centerline coincides with the line formed by intersection of the horizontal and vertical planes perpendicular to the midsagittal plane passing through the designated impact point.

(4) Adjust the dummy so that its midsagittal plane is vertical and the rear surfaces of the thorax and buttocks are tangent to a transverse vertical plane.

(5) Impact the pelvis with the test probe so that at the moment of impact the probe's longitudinal centerline falls within 2 degrees of the line specified in (3) above.

(6) Guide the test probe during impact so that it moves with no significant lateral, vertical or rotational movement.

(7) Allow a time period of at least 2 hours between successive tests of the pelvis.

§ 572.44 Instrumentation and test conditions.

(a) The test probe used for lateral thoracic and pelvis impact tests is a 6 inch diameter cylinder that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.5 inches.

(b) Three accelerometers are mounted in the thorax for measurement of lateral accelerations with each accelerometer's sensitive axis aligned to be closely perpendicular to the thorax's midsagittal plane. The accelerometers are mounted in the following locations:

(1) One accelerometer is mounted on the Thorax to Lumbar Adaptor (SID-005) by means of a T12 Accelerometer Mounting Platform (SID-009) and T12 Accelerometer Mount (ID-038) with its seismic mass center at any distance up to 0.4 inches from a surface point on the Thorax to Lumbar Adaptor where two perpendicular planes aligned with the adaptor's vertical and horizontal center lines intersect.

(2) Two accelerometers are mounted, one on the top and the other at the bottom part of the Rib Bar (SID-024) on the struck side. Their seismic mass centers are at any distance up to .4 inches from a point on the Rib Bar surface located on its longitudinal center line .75 inches from the top for the top accelerometer and .75 inches from the bottom, for the bottom accelerometer.

(c) One accelerometer is mounted in the pelvis for measurement of the lateral acceleration with its sensitive axis perpendicular to the pelvic midsagittal plane. The accelerometer is mounted on the rear wall of the instrument cavity (Drawing SID-087), with its seismic mass center located up to 0.30 inches from the point of intersection of the cover plate centerlines and 0.34 inches rearward of the rear wall of the instrument cavity.

(d) Instrumention and sensors used must conform to the SAE J-211 (1980) recommended practice requirements. The outputs of the accelerometers installed in the dummy are then processed with the software for the Finite Impulse Response (FIR) filter (FIR 100 software). The FORTRAN program for this FIR 100 software (FIR100 Filter Program, Version 1.0, July 16, 1990) is incorporated by reference in this Part. The data are processed in the following manner:

(1) Analog data recorded in accordance with SAE J-211 (1980) recommended practice channel class 1000 specification;

(2) Filter the data with a 300 Hz, SAE Class 180 filter;

(3) Subsample the data to a 1600 Hz sampling rate;

(4) Remove the bias from the subsampled data, and

(5) Filter the data with the FIR100 Filter Program (Version 1.0, July 16, 1990), which has the following characteristics—

(A) Passband frequency, 100 Hz.

(B) Stopband frequency, 189 Hz.

(C) Stopband gain, -50 db.

(D) Passband ripple, 0.0225 db.

(e) The mountings for the spine, rib and pelvis accelerometers shall have no resonance frequency within a range of 3 times the frequency range of the applicable channel class.

(f) Limb joints of the test dummy are set at the force between 1-2 g's, which just supports the limbs-weight when the limbs are extended horizontally forward. The force required to move a limb segment does not exceed 2 g's throughout the range of limb motion.

(g) Performance tests are conducted at any temperature from 66° F to 78° F and at any relative humidity from 10 percent to 70 percent after exposure of the dummy to these conditions for a period of not less than 4 hours.

(h) For the performance of tests specified in §§ 572.42 and 572.43, the dummy is positioned as follows:

(1) The dummy is placed on a flat, rigid, clean, dry, horizontal smooth aluminum surface whose length and width dimensions are not less than 16 inches, so that the dummy's midsagittal plane is vertical and centered on the test surface. The dummy's torso is positioned to meet the requirements of § 572.42 and § 572.43. The seating surface is without the back support and the test dummy is positioned so that the dummy's midsagittal plane is vertical and centered on the seat surface.

(2) The legs are positioned so that their centerlines are in planes parallel to the midsagittal plane.

(3) Performance pre-tests of the assembled dummy are separated in time by a period of not less than 20 minutes unless otherwise specified.

(4) Surfaces of the dummy components are not painted except as specified in this part or in drawings subtended by this part.

Issued on October 24, 1990.

Jerry Ralph Curry
Administrator

55 F.R. 45757
October 30, 1990

PREAMBLE TO AN AMENDMENT TO PART 572
Anthropomorphic Test Dummies

(Docket and RIN Numbers Not Issued)

ACTION: Final rule; technical amendment.

SUMMARY: This rule corrects the erroneous dates shown in the Code of Federal Regulations for the Anthropomorphic Test Dummy Parts List and the Parts List Index for the Hybrid III test dummy.

EFFECTIVE DATE: October 14, 1992.

SUPPLEMENTARY INFORMATION: 49 CFR Part 572, *Anthropomorphic Test Dummies*, specifies the dimensions, physical attributes, and performance characteristics of the Hybrid III test dummy in Subpart E. A general description of the Hybrid III test dummy is set forth in 572.31(a), which references six items that comprise the drawing and specifications package for the test dummy. The first of these six items is set forth in 572.31(a)(1) as follows:

> The Anthropomorphic Test Dummy Parts List, dated December 15, 1987, and containing 13 pages, and a Parts List Index, dated December 15, 1987, containing 8 pages.

The Dummy Parts List and the Parts List Index were approved for incorporation by reference by the Director of the Federal Register. As a part of that approval, the Dummy Parts List and the Parts List Index are on file in the reference library of the office of the *Federal Register* and in the general reference section of the NHTSA Docket Section. However, the Dummy Parts List and the Parts List Index that are on file are both dated March 10, 1988. These March 10, 1988 lists are the correct version and the Parts List Index that the agency intended to incorporate into 49 CFR Part 572. Accordingly, this rule amends 572.31(a) so that it refers to the Dummy Parts List and Parts List Index of March 10, 1988.

This correction imposes no duties or responsibilities on any party, nor does it alter any existing obligations. Instead, it simply ensures that the public will have an accurate copy of Part 572 in Title 49 of the Code of Federal Regulations. Accordingly, NHTSA finds for good cause that notice and opportunity for comment on this correction are unnecessary, and this correction is effective upon publication in the *Federal Register*.

In consideration of the foregoing, 49 CFR § 572.31(a)(1) amended as follows: Section 572.31 is amended by revising paragraph (a)(1) to read as follows: 572.31 General description.

(a)

* * * * *

(1) The Anthropomorphic Test Dummy Part List, dated March 10, 1988, and containing 13 pages, and a Parts List Index, dated March 10, 1988, containing 8 pages.

* * * * *

Issued on October 7, 1992.

Marion C. Blakey
Administrator

57 F.R. 47009
October 14, 1992

PART 572—ANTHROPOMORPHIC TEST DUMMIES

Subpart A—General

§ 572.1 Scope. This part describes the anthropomorphic test dummies that are to be used for compliance testing of motor vehicles and motor vehicle equipment with motor vehicle safety standards.

§ 572.2 Purpose. The design and performance headings: criteria specified in this part are intended to describe measuring tools with sufficient precision to give repetitive and correlative results under similar test conditions and to reflect adequately the protective performance of a vehicle or item, of motor vehicle equipment, with respect to human occupants.

§ 572.3 Application. This part does not in itself impose duties or liabilities on any person. It is a description of tools that measure the performance of occupant protection systems required by the safety standards that incorporate it. It is designed to be referenced by, and become a part of, the test procedures specified in motor vehicle safety standards such as Standard No. 208, Occupant Crash Protection.

§ 572.4 Terminology.

(a) The term "dummy," when used in this Subpart A, refers to any test device described by this part. The term "dummy," when used in any other subpart of this part, refers to the particular dummy described in that part.

(b) Terms describing parts of the dummy, such as "head," are the same as names for corresponding parts of the human body.

(c) The term "unimodal," when used in [Subpart C and I], refers to an acceleration-time curve which has only one prominent peak. **(56 F.R. 57830—November 14, 1991. Effective: May 12, 1992)**

Subpart B—50th Percentile Male

§ 572.5 General description.

(a) The dummy consists of the component assemblies specified in Figure 1, which are described in their entirety by means of approximately 250 drawings and specifications that are grouped by component assemblies under the following nine headings:

SA 150 M070	Right arm assembly
SA 150 M071	Left arm assembly
SA 150 M050	Lumbar spine assembly
SA 150 M060	Pelvis and abdomen assembly
SA 150 M080	Right leg assembly
SA 150 M081	Left leg assembly
SA 150 M010	Head assembly
SA 150 M020	Neck assembly
SA 150 M030	Shoulder-thorax assembly

(b) The drawings and specifications referred to in fros regulation that are not set forth in full are hereby incorporated in this part by reference. These materials are thereby made part of this regulation. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*.

(c) The materials incorporated by reference are available for examination in Docket 73–08, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street S.W., Washington, D.C. 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street N.W., Washington, D.C. 20005 (202) 628–6667. The drawings and specifications are also on file in the reference library of the Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

(d) Adjacent segments are joined in a manner such that throughout the range of motion and also under crash-impact conditions there is no contact between metallic elements except for contacts that exist under static conditions.

(e) The structural properties of the dummy are such that the dummy conforms to this part in

every respect both before and after being used in vehicle tests specified in Standard No. 208 (§ 571.208).

(f) A specimen of the dummy is available for surface measurements, and access can be arranged through: Office of Vehicle Safety Standards, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590.

§ 572.6 Head.

(a) The head consists of the assembly shown as number SA 150 M010 in Figure 1 and conforms to each of the drawings subtended by number SA 150 M010.

(b) When the head is dropped from a height of 10 inches in accordance with paragraph (c) of this section, the peak resultant accelerations at the location of the accelerometers mounted in the head form in accordance with § 572.11(b) shall be not less than 210g, and not more than 260g. The acceleration/time curve for the test shall be unimodal and shall lie at or above the 100g level for an interval not less than 0.9 milliseconds and not more than 1.5 milliseconds. The lateral acceleration vector shall not exceed 10g.

(c) *Test procedure:*

(1) Suspend the head as shown in Figure 2, so that the lowest point on the forehead is 0.5 inches below the lowest point on the dummy's nose when the midsagittal plane is vertical.

(2) Drop the head from the specified height by a means that ensures instant release onto a rigidly supported flat horizontal steel plate, 2 inches thick and 2 feet square, which has a clean, dry surface and any microfinish of not less than 8 microinches (rms) and not more than 80 microinches (rms).

(3) Allow a time period of at least 2 hours between successive tests on the same head.

§ 572.7 Neck.

(a) The neck consists of the assembly shown as number SA 150 M020 in Figure 1 and conforms to each of the drawings subtended by number SA 150 M020.

(b) When the neck is tested with the head in accordance with paragraph (c) of this section, the head shall rotate in reference to the pendulum's longitudinal centerline a total of 68° ± 5° about its center of gravity, rotating to the extent specified in the following table at each indicated point in time, measured from impact, with a chordal displacement measured at its center of gravity that is within the limits specified. The chordal displacement at time T is defined as the straight line distance between (1) the position relative to the pendulum arm of the head center of gravity at time zero, and (2) the position relative to the pendulum arm of the head center of gravity at time T as illustrated by Figure 3. The peak resultant acceleration recorded at the location of the accelerometers mounted in the head form in accordance with § 572.11(b) shall not exceed 26g. The pendulum shall not reverse direction until the head's center of gravity returns to the original zero time position relative to the pendulum arm.

Rotation (degrees)	Time (ms) ± (2 + .08T)	Chordal Displacement (inches ±0.5)
0	0	0.0
30	30	2.6
60	46	4.8
Maximum	60	5.5
60	75	4.8
30	95	2.6
0	112	0.0

(c) *Test procedure:*

(1) Mount the head and neck on a rigid pendulum as specified in Figure 4, so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal centerline. Mount the neck directly to the pendulum as shown in Figure 4.

(2) Release the pendulum and allow it to fall freely from a height such that the velocity at impact is 23.5 ± 2.0 feet per second (fps), measured at the center of the accelerometer specified in Figure 4.

(3) Decelerate the pendulum to a stop with an acceleration-time pulse described as follows:

(i) Establish 5g and 20g levels on the $a-t$ curve.

(ii) Establish t_1 at the point where the rising $a-t$ curve first crosses the 5g level, t_2 at the point where the rising $a-t$ curve first crosses the 20g level, t_3 at the point where the decaying $a-t$ curve last crosses the 20g level, and t_4 at the point where the decaying $a-t$ curve first crosses the 5g level.

(iii) t_2-t_1 shall be not more than 3 milliseconds.

(iv) t_3-t_2 shall be not less than 25 milliseconds and not more than 30 milliseconds.

(v) $t_4 - t_3$ shall be not more than 10 milliseconds.

(vi) The average deceleration between t_2 and t_3 shall be not less than 20g and not more than 24g.

(4) Allow the neck to flex without impact of the head or neck with any object other than the pendulum arm.

§ 572.8 Thorax.

(a) The thorax consists of the assembly shown as number SA 150 M030 in Figure 1, and conforms to each of the drawings subtended by number SA 150 M030.

(b) The thorax contains enough unobstructed interior space behind the rib cage to permit the midpoint of the sternum to be depressed 2 inches without contact between the rib cage and other parts of the dummy or its instrumentation, except for instruments specified in subparagraph (d)(7) of this section.

(c) When impacted by a test probe conforming to § 572.11(a) at 14 fps and at 22 fps in accordance with paragraph (d) of this section, the thorax shall resist with forces measured by the test probe of not more than 1450 pounds and 2250 pounds, respectively, and shall deflect by amounts not greater than 1.1 inches and 1.7 inches, respectively. The internal hysteresis in each impact shall not be less than 50 percent and not more than 70 percent.

(d) *Test Procedure:*

(1) With the dummy seated without back support on a surface as specified in § 572.11(i) and in the orientation specified in § 572.11(i), adjust the dummy arms and legs until they are extended horizontally forward parallel to the midsagittal plane.

(2) Place the longitudinal center line of the test probe so that it is 17.7 ± 0.1 inches above the seating surface at impact.

(3) Align the test probe specified in § 572.11 (a) so that at impact its longitudinal centerline coincides within 2 degrees of a horizontal line in the dummy's midsagittal plane.

(4) Adjust the dummy so that the surface area on the thorax immediately adjacent to the projected longitudinal center line of the test probe is vertical. Limb support, as needed to achieve and maintain this orientation, may be provided by placement of a steel rod of any diameter not less than one-quarter of an inch and not more than three-eighths of an inch, with hemispherical ends, vertically under the limb at its projected geometric center.

(5) Impact the thorax with the test probe so that its longitudinal centerline falls within 2 degrees of a horizontal line in the dummy's midsagittal plane at the moment of impact.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

(7) Measure the horizontal deflection of the sternum relative to the thoracic spine along the line established by the longitudinal centerline of the probe at the moment of impact, using a potentiometer mounted inside the sternum.

(8) Measure hysteresis by determining the ratio of the area between the loading and unloading portions of the force deflection curve to the area under the loading portion of the curve.

§ 572.9 Lumbar spine, abdomen, and pelvis.

(a) The lumbar spine, abdomen, and pelvis consist of the assemblies designated as numbers SA 150 M050 and SA 150 M060 in Figure 1 and conform to the drawings subtended by these numbers.

(b) When subjected to continuously applied force in accordance with paragraph (c) of this section, the lumbar spine assembly shall flex by an amount that permits the rigid thoracic spine to rotate from its initial position in accordance with Figure 11 by the number of degrees shown below at each specified force level, and straighten upon removal of the force to within 12 degrees of its initial position in accordance with Figure 11.

Fiexion (degrees)	*Force* (±6 pounds)
0	0
20	28
30	40
40	52

(c) *Test procedure:*

(1) Assemble the thorax, lumbar spine, pelvic, and upper leg assemblies (above the femur force transducers), ensuring that all component surfaces are clean, dry, and untreated unless otherwise specified, and attach them to the horizontal fixture shown in Figure 5 at the two

link rod pins and with the mounting brackets for the lumbar test fixtures illustrated in Figure 6 to 9.

(2) Attach the rear mounting of the pelvis to the pelvic instrument cavity rear face at the four ¼″ cap screw holes and attach the front mounting at the femur axial rotation joint. Tighten the mountings so that the pelvic-lumbar adapter is horizontal and adjust the femur friction plungers at each hip socket joint to 240 inch-pounds torque.

(3) Flex the thorax forward 50° and the rearward as necessary to return it to its initial position in accordance with Figure 11 unsupported by external means.

(4) Apply a forward force perpendicular to the thorax instrument cavity rear face in the midsagittal plane 15 inches above the top surface of the pelvic-lumbar adapter. Apply the force at any torso deflection rate between .5 and 1.5 degrees per second up to 40° of flexion but no further, continue to apply for 10 seconds that force necessary to maintain 40° of flexion, and record the force with an instrument mounted to the thorax as shown in Figure 5. Release all force as rapidly as possible and measure the return angle 3 minutes after the release.

(d) When the abdomen is subjected to continuously applied force in accordance with paragraph (e) of this section, the abdominal forcedeflection curve shall be within the two curves plotted in Figure 10.

(e) *Test procedure:*

(1) Place the assembled thorax, lumbar spine, and pelvic assemblies in a supine position on a fiat rigid, smooth, dry, clean horizontal surface, ensuring that all component surfaces are clean, dry, and untreated unless otherwise specified.

(2) Place a rigid cylinder 6 inches in diameter and 18 inches long transversely across the abdomen, so that the cylinder is symmetrical about the midsagittal plane, with its longitudinal centerline horizontal and perpendicular to the midsagittal plane at a point 9.2 inches above the bottom line of the buttocks, measured with the dummy positioned in accordance with Figure 11.

(3) Establish the zero deflection point as the point at which a force of 10 pounds has been reached.

(4) Apply a vertical downward force through the cylinder at any rate between 0.25 and 0.35 inches per second.

(5) Guide the cylinder so that it moves without significant lateral or rotational movement.

§ 572.10 Limbs.

(a) The limbs consist of the assemblies shown as numbers SA 150 M070, SA 150 M071, SA 150 M080, and SA 150 M081 in Figure 1 and conform to the drawings subtended by these numbers.

(b) When each knee is impacted at 6.9 ft/ sec. in accordance with paragraph (c) of this section, the maximum force on the femur shall be not more than 2500 pounds and not less than 1850 pounds, with a duration above 1000 pounds of not less than 1.7 milliseconds.

(c) *Test procedure:*

(1) Seat the dummy without back support on a surface as specified in § 572.11(i) that is 17.3 ± 0.2 inches above a horizontal surface, oriented as specified in § 572.11(i), and with the hip joint adjustment at any setting between 1g and 2g. Place the dummy legs in planes parallel to its midsagittal plane (knee pivot centerline perpendicular to the midsagittal plane) and with the feet flat on the horizontal surface. Adjust the feet and lower legs until the lines between the midpoints of the knee pivots and the ankle pivots are at any angle not less than 2 degrees and not more than 4 degrees rear of the vertical, measured at the centerline of the knee pivots.

(2) Reposition the dummy if necessary so that the rearmost point of the lower legs at the level one inch below the seating surface remains at any distance not less than 5 inches and not more than 6 inches forward of the forward edge of the seat.

(3) Align the test probe specified in § S72.11(a) so that at impact its longitudinal centerline coincides within 20 with the longitudinal centerline of the femur.

(4) Impact the knee with the test probe moving horizontally and parallel to the midsagittal plane at the specified velocity.

(5) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

§572.11 Test conditions and instrumentation.

(a) The test probe used for thoracic and knee impact tests is a cylinder 6 inches in diameter that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right face that is rigid and that has an edge radius of 0.5 inches.

(b) Accelerometers are mounted in the head on the horizontal transverse bulkhead shown in the drawings subreferenced under assembly No. SA 150 M010 in Figure 1, so that their sensitive axes intersect at a point in the midsagittal plane 0.5 inches above the horizontal bulkhead and 1.9 inches ventral of the vertical mating surface of the skull with the skull cover. One accelerometer is aligned with its sensitive axis perpendicular to the horizonal bulkhead in the midsagittal plane and with its seismic mass center at any distance up to 0.3 inches superior to the axial intersection point. Another accelerometer is aligned with its sensitive axis parallel to the horizontal bulkhead and perpendicular to the midsagittal plane, and with its seismic mass center at any distance up to 1.3 inches to the left of the axial intersection point (left side of dummy is the same as that of man). A third accelerometer is aligned with its sensitive axis parallel to the horizontal bulkhead in the midsagittal plane, and with its seismic mass center at any distance up to 1.3 inches dorsal to the axial intersection point.

(c) Accelerometers are mounted in the thorax by means of a bracket attached to the rear vertical surface (hereafter ''attachment surface'') of the thoracic spine so that their sensitive axes intersect at a point in the midsagittal plane 0.8 inches below the upper surface of the plate to which the neck mounting bracket is attached and 3.2 inches perpendicularly forward of the surface to which the accelerometer bracket is attached. One accelerometer has its sensitive axis oriented parallel to the attachment surface in the midsagittal plane, with its seismic mass center at any distance up to 1.3 inches inferior to the intersection of the sensitive axes specified above. Another accelerometer has its sensitive axis oriented parallel to the attachment surface and perpendicular to the midsagittal plane, with its seismic mass center at any distance up to 0.2 inches to the right of the intersection of the sensitive axes specified above. A third accelerometer has its sensitive axis oriented perpendicular to the attachment surface in the midsagittal plane, with its seismic mass center at any distance up to 1.3 inches dorsal to the intersection of the sensitive axes specified above. Accelerometers are oriented with the dummy in the position specified in §572.11(i).

(d) A force-sensing device is mounted axially in each femur shaft so that the transverse centerline of the sensing element is 4.25 inches from the knee's center of rotation.

(e) The outputs of acceleration and forcesensing devices installed in the dummy and in the test apparatus specified by this Part are recorded in individual data channels that conform to the requirements of SAE Recommended Practice J211a, December 1971, with channel classes as follows:

(1) Head acceleration—Class 1000.

(2) Pendulum acceleration—Class 60.

(3) Thorax acceleration—Class 180.

(4) Thorax compression—Class 180.

(5) Femur force—Class 600.

(f) The mountings for sensing devices have no resonance frequency within a range of 3 times the frequency range of the applicable channel class.

(g) Limb joints are set at 1g, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment does not exceed 2g throughout the range of limb motion.

(h) Performance tests are conducted at any temperature from 66° F to 78° F and at any relative humidity from 10 percent to 70 percent after exposure of the dummy to these conditions for a period of not less than 4 hours.

(i) For the performances tests specified in §§572.8, 572.9, and 572.10, the dummy is positioned in accordance with Figure 11 as follows:

(1) The dummy is placed on a flat, rigid, smooth, clean, dry, horizontal, steel test surface whose length and width dimensions are not less than 16 inches, so that the dummy's midsagittal plane is vertical and centered on the test surface and the rearmost points on its lower legs at the level of the test surface are at any distance not less than 5 inches and not more than 6 inches forward of the forward edge of the test surface.

(2) The pelvis is adjusted so that the upper surface of the lumbar-pelvic adapter is horizontal.

(3) The shoulder yokes are adjusted so that they are at the midpoint of their anterior posterior travel with their upper surfaces horizontal.

(4) The dummy is adjusted so that the rear surfaces of the shoulders and buttocks are tangent to a transverse vertical plane.

(5) The upper legs are positioned symmetrically about the midsagittal plane so that the distance between the knee pivot bolt heads is 11.6 inches.

(6) The lower legs are positioned in planes parallel to the midsagittal plane so that the lines between the midpoint of the knee pivots and the ankle pivots are vertical.

(j) The dummy's dimensions, as specified in drawing number SA 150 M002, are determined as follows:

(1) With the dummy seated as specified in paragraph (i), the head is adjusted and secured so that its occiput is 1.7 inches forward of the transverse vertical plane with the vertical mating surface of the skull with its cover parallel to the transverse vertical plane.

(2) The thorax is adjusted and secured so that the rear surface of the chest accelerometer mounting cavity is inclined 30 forward of vertical.

(3) Chest and waist circumference and chest depth measurements are taken with the dummy positioned in accordance with paragraph (i) (1) and (2) of this section.

(4) The chest skin and abdominal sac are removed and all following measurements are made without them.

(5) Seated height is measured from the seating surface to the uppermost point on the head-skin surface.

(6) Shoulder pivot height is measured from the seating surface to the center of the arm elevation pivot.

(7) H-point locations are measured from the seating surface to the center of the holes in the pelvis flesh covering in line with the hip motion ball.

(8) Knee pivot distance from the backline is measured to the center of the knee pivot bolt head.

(9) Knee pivot distance from floor is measured from the center of the knee pivot bolt head to the bottom of the heel when the foot is horizontal and pointing forward.

(10) Shoulder width measurement is taken at arm elevation pivot center height with the centerlines between the elbow pivots and the shoulder pivots vertical.

(11) Hip width measurement is taken at widest point of pelvic section.

(k) Performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise noted.

(1) Surfaces of dummy components are not painted except as specified in this part or in drawings subtended by this part.

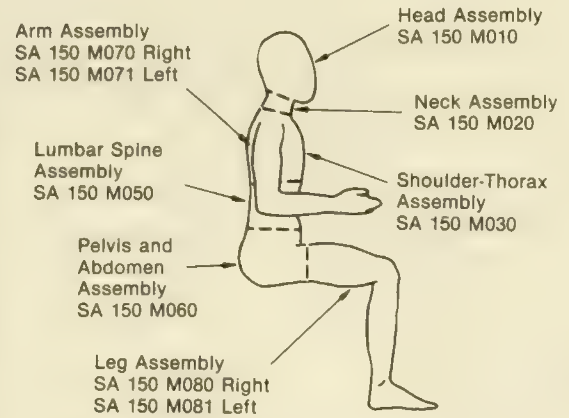
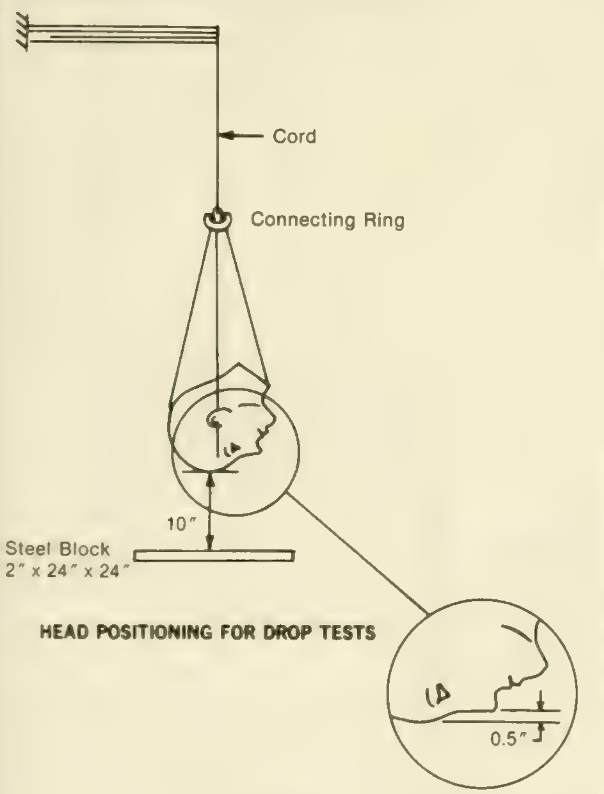


Figure 2.—Head Positioning For Drop Tests



HEAD POSITIONING FOR DROP TESTS

Figure 2.

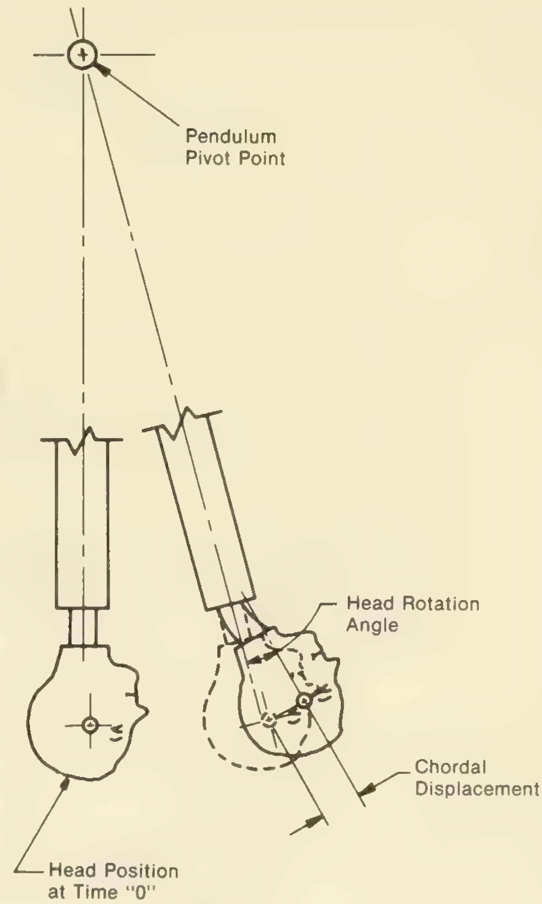
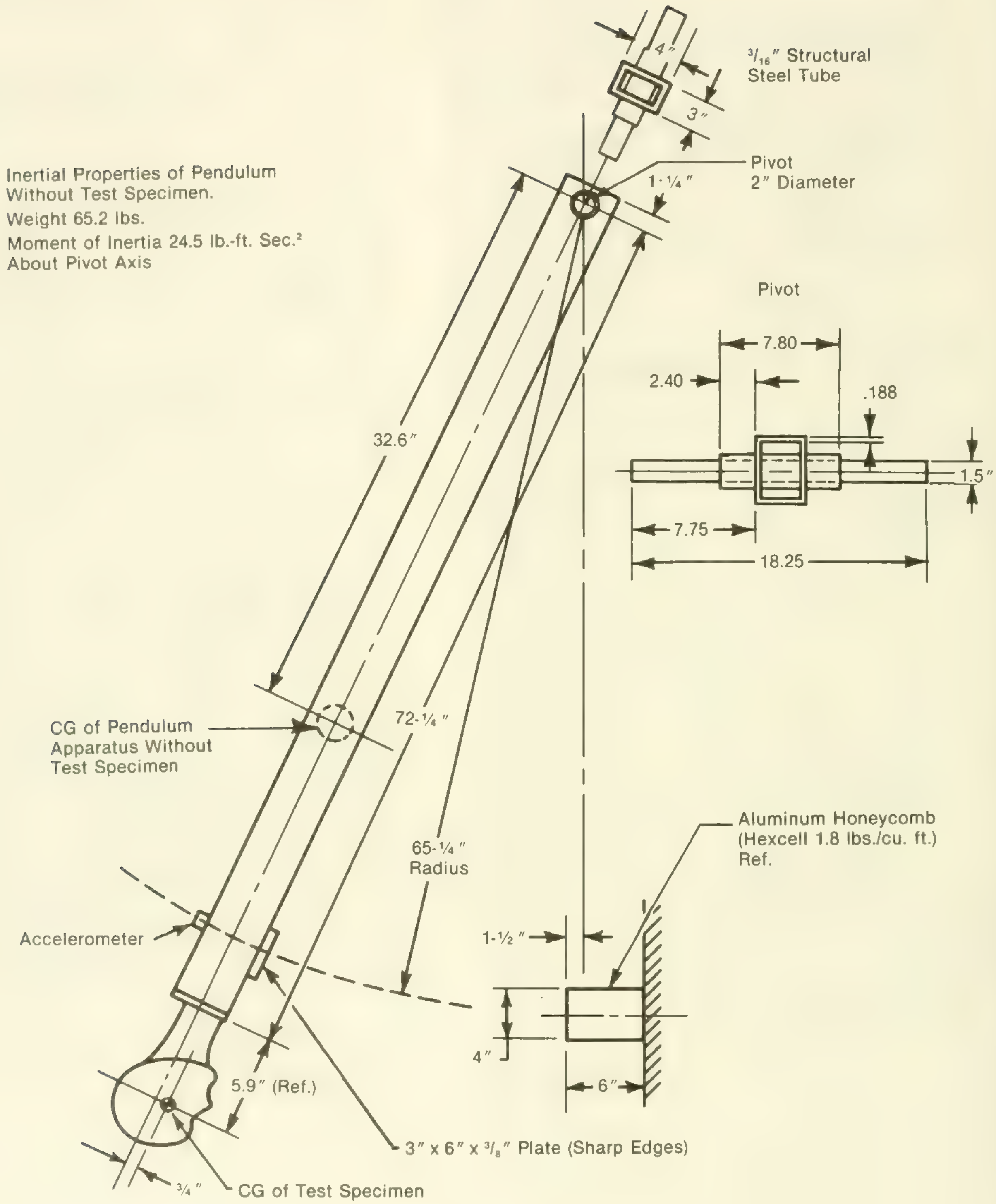
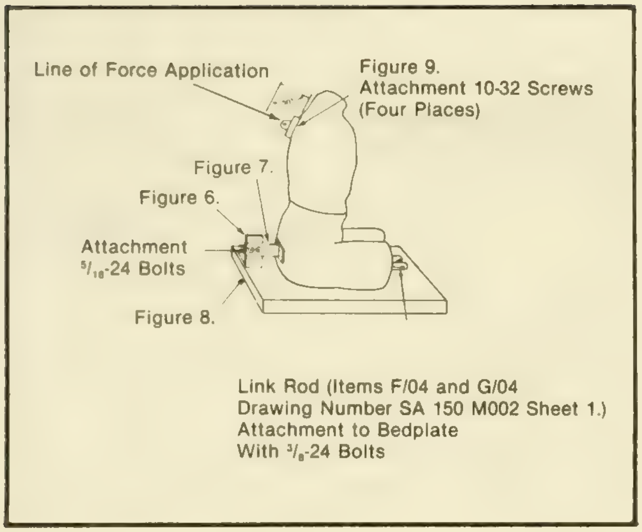


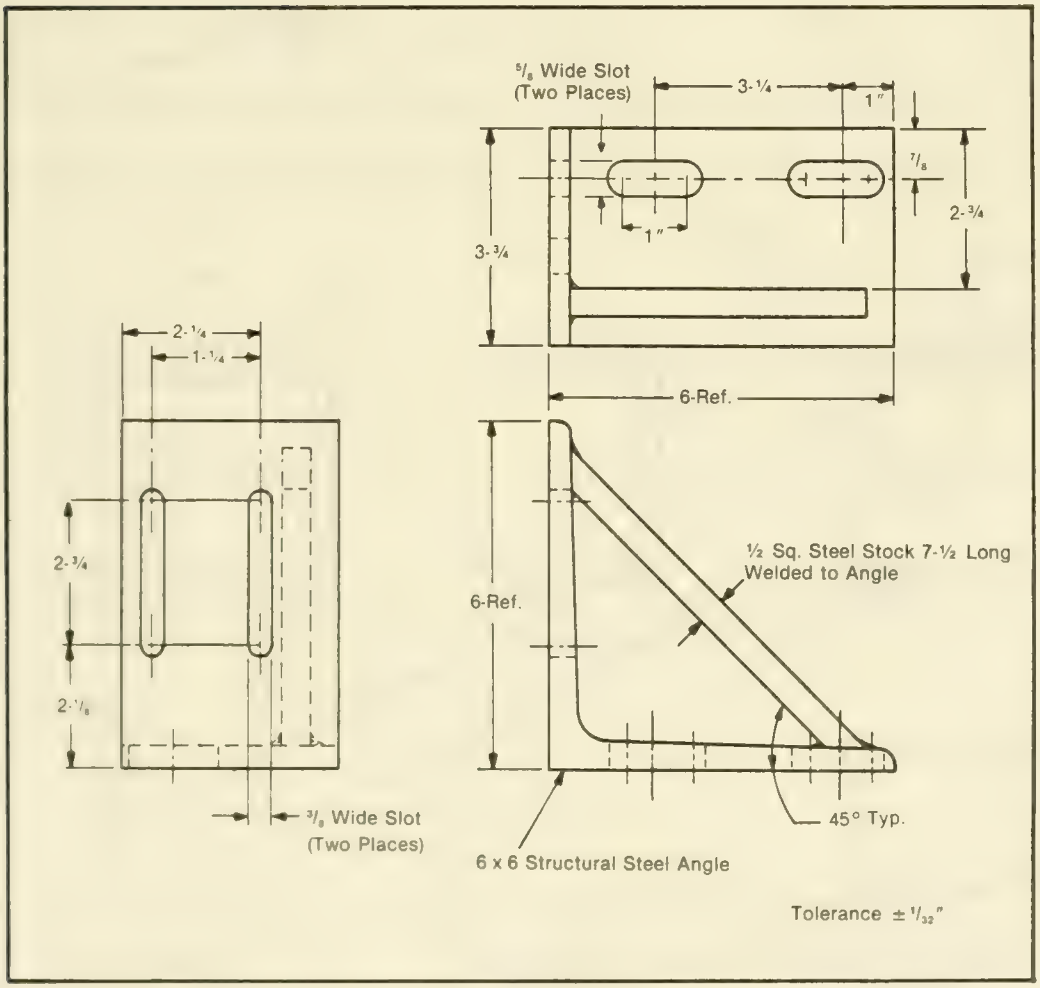
Figure 3.—Neck Component Test



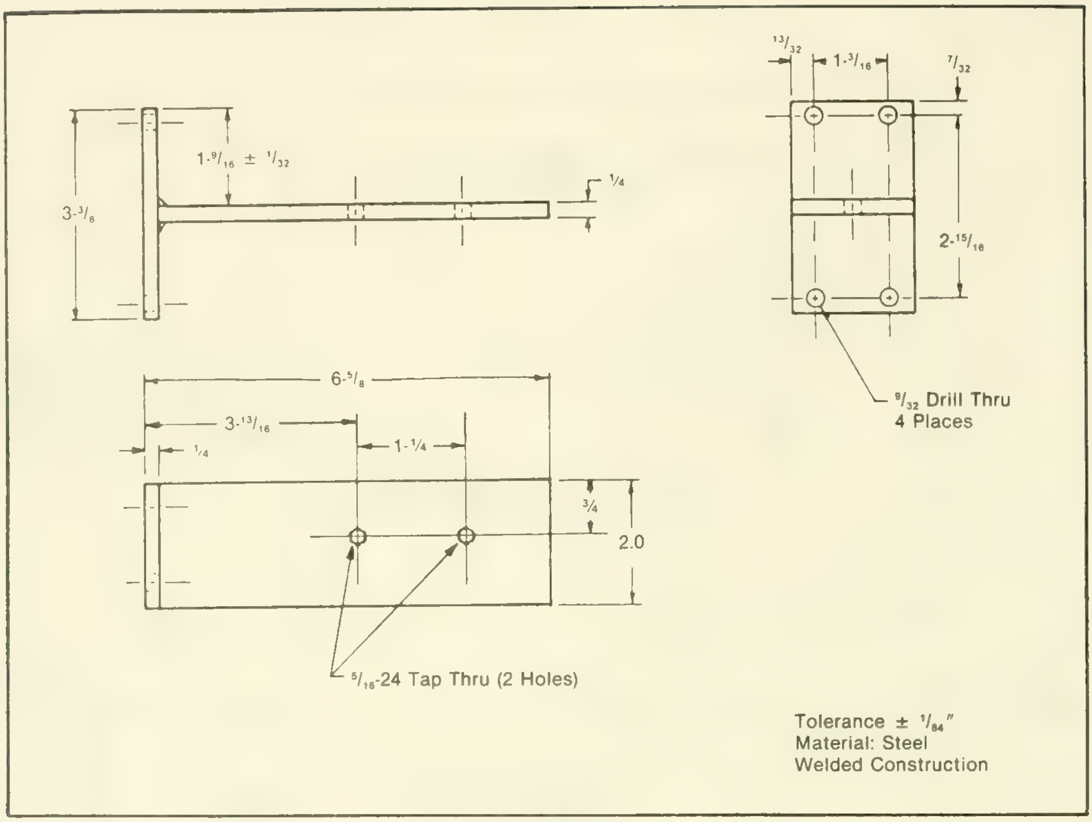
4″
3/16″ Structural Steel Tube
3″
Pivot 2″ Diameter
1-1/4″
Inertial Properties of Pendulum Without Test Specimen.
Weight 65.2 lbs.
Moment of Inertia 24.5 lb.-ft. Sec.²
About Pivot Axis
Pivot
7.80
2.40
.188
32.6″
1.5″
7.75
18.25
CG of Pendulum Apparatus Without Test Specimen
72-1/4″
Aluminum Honeycomb (Hexcell 1.8 lbs./cu. ft.) Ref.
65-1/4″ Radius
Accelerometer
1-1/2″
4″
6″
5.9″ (Ref.)
3″ x 6″ x 3/8″ Plate (Sharp Edges)
3/4″
CG of Test Specimen

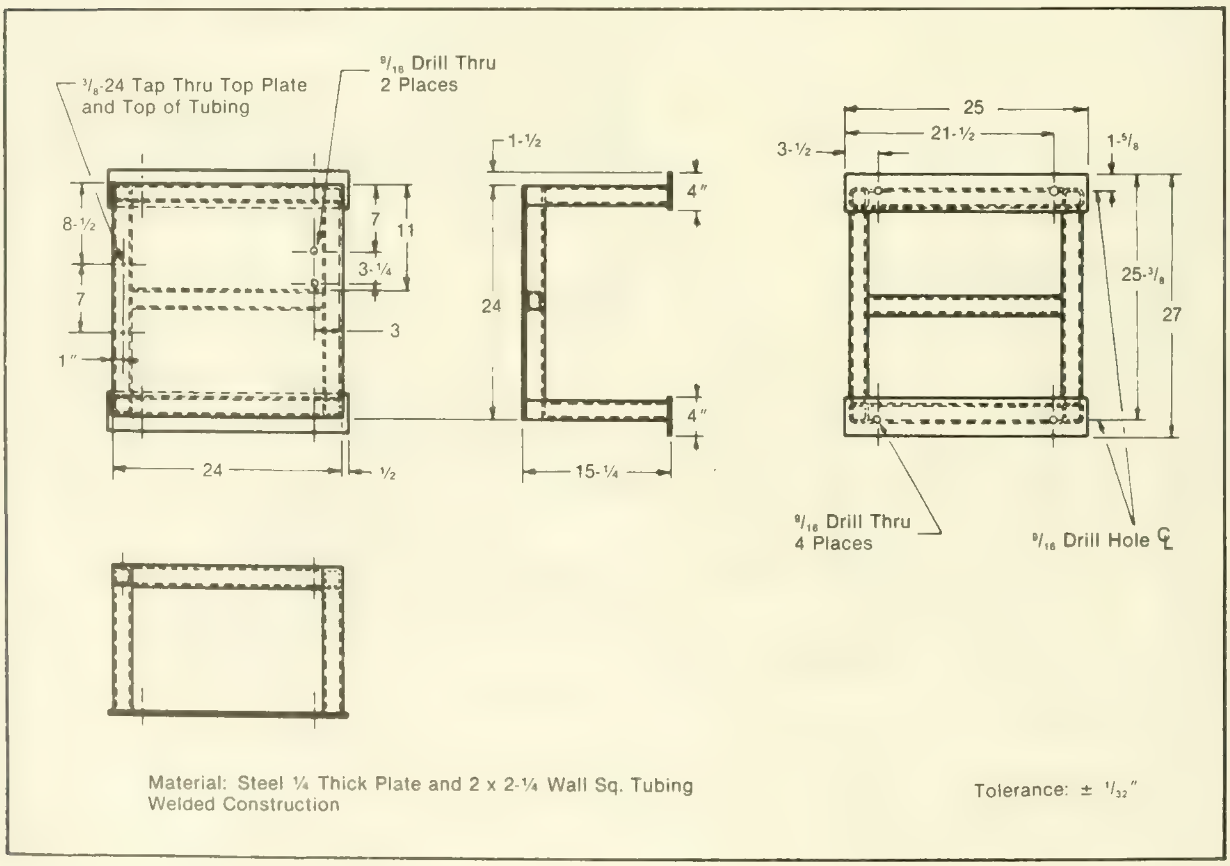


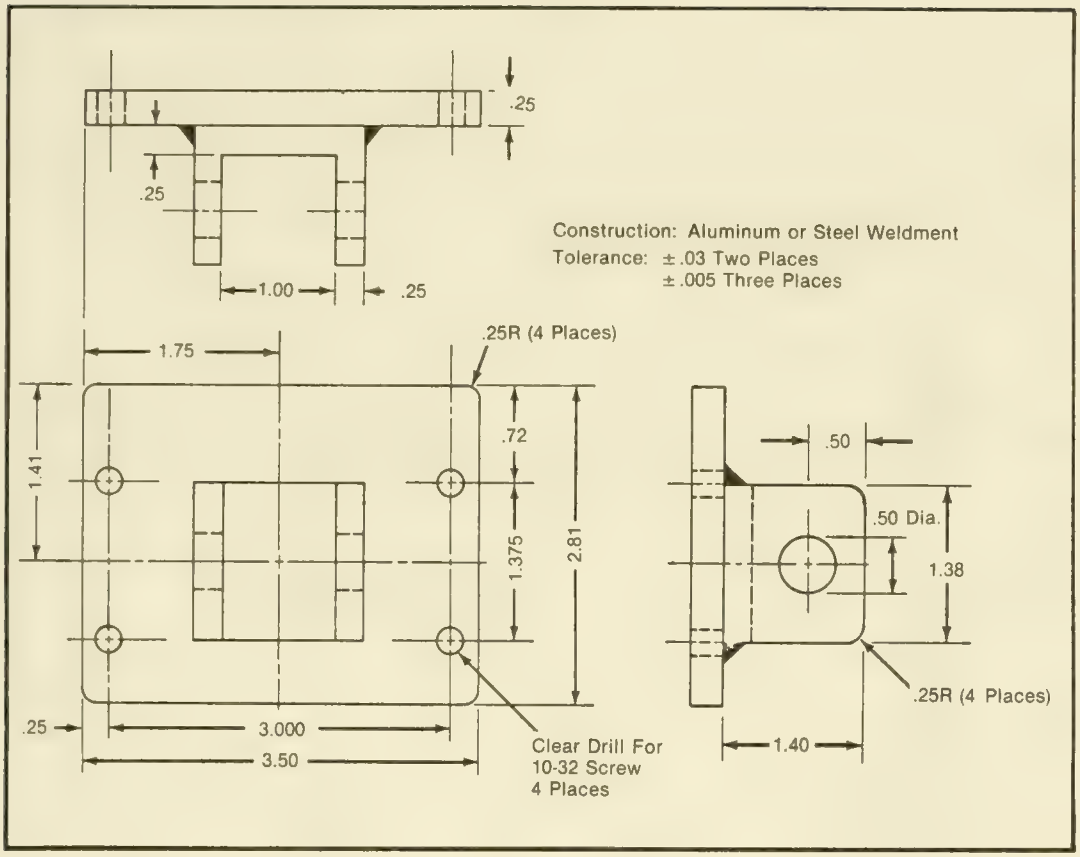
Line of Force Application
Figure 9.
Attachment 10-32 Screws
(Four Places)
Figure 7.
Figure 6.
Attachment
5/16-24 Bolts
Figure 8.
Link Rod (Items F/04 and G/04
Drawing Number SA 150 M002 Sheet 1.)
Attachment to Bedplate
With 3/8-24 Bolts

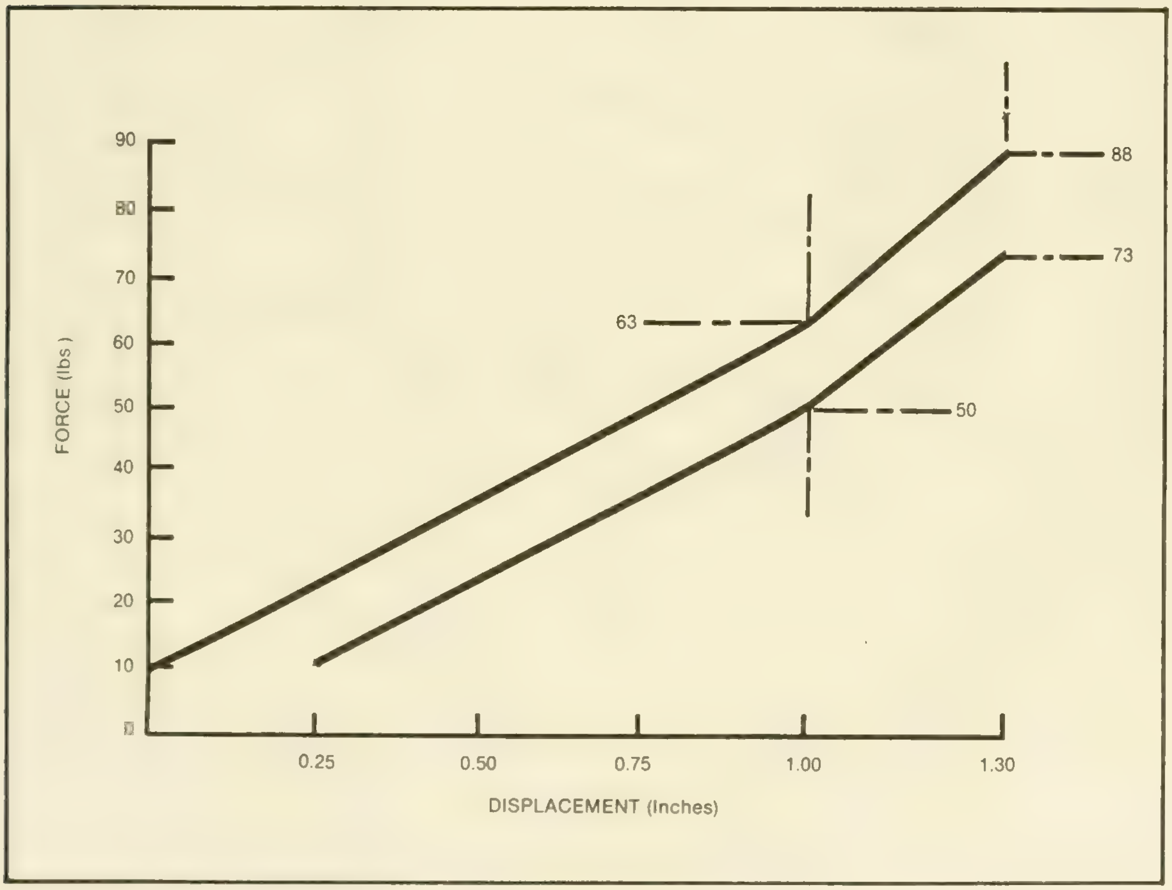


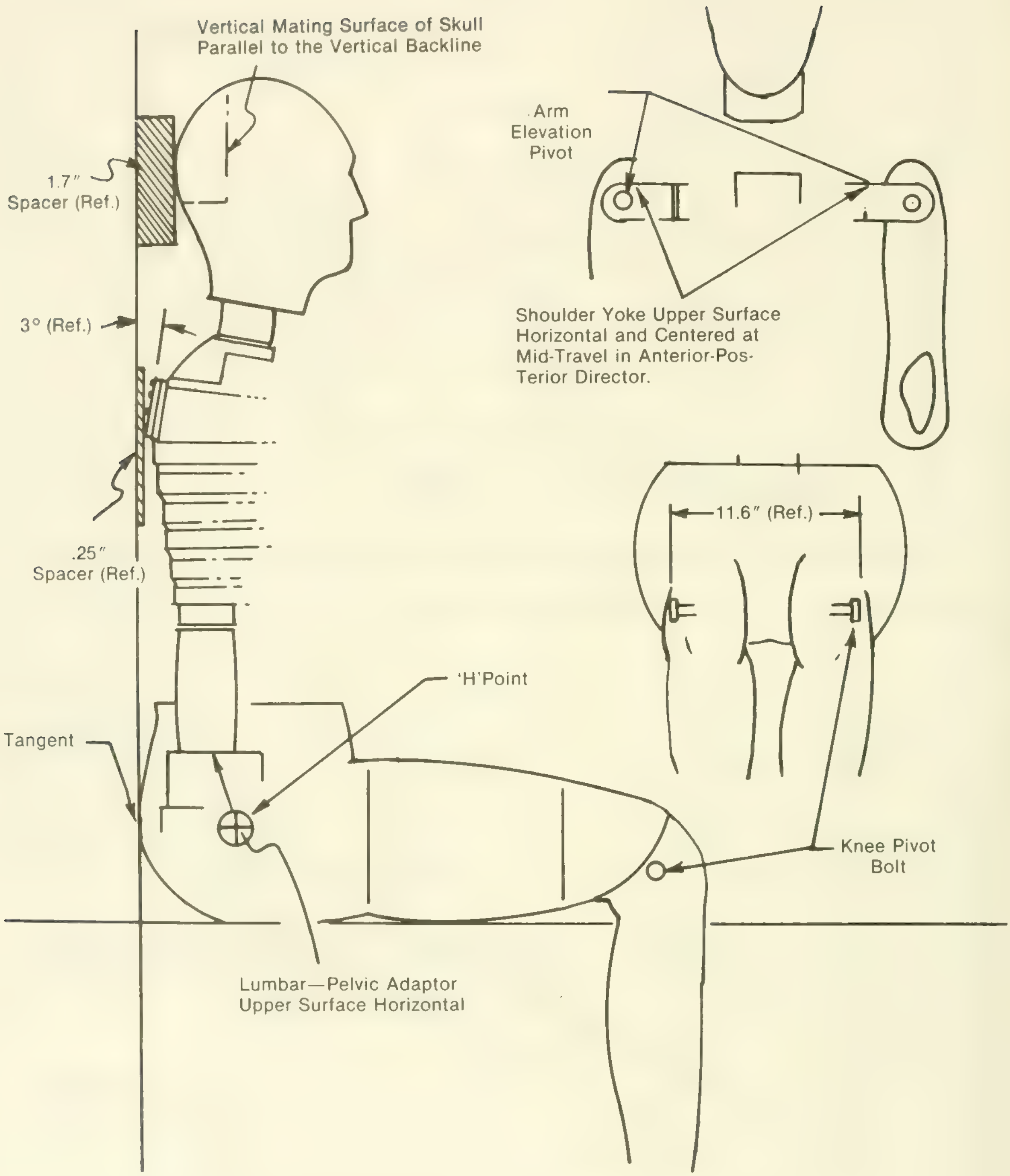
5/8 Wide Slot
(Two Places)
3-1/4
1"
7/8
2-3/4
3-3/4
1"
6-Ref.
2-1/4
1-1/4
2-3/4
2-1/8
3/8 Wide Slot
(Two Places)
6-Ref.
½ Sq. Steel Stock 7-½ Long
Welded to Angle
45° Typ.
6 x 6 Structural Steel Angle
Tolerance ± 1/32"


13/32
1-3/16
7/32
1-9/16 ± 1/32
1/4
3-3/8
2-15/16
9/32 Drill Thru
4 Places
6-5/8
3-13/16
1-1/4
1/4
3/4
2.0
5/16-24 Tap Thru (2 Holes)
Tolerance ± 1/64"
Material: Steel
Welded Construction


3/8-24 Tap Thru Top Plate
and Top of Tubing
9/16 Drill Thru
2 Places
1-1/2
25
21-1/2
3-1/2
1-5/8
8-1/2
7
11
3-1/4
7
3
1"
24
4"
4"
25-3/8
27
24
1/2
15-1/4
9/16 Drill Thru
4 Places
9/16 Drill Hole ℄
Material: Steel 1/4 Thick Plate and 2 x 2-1/4 Wall Sq. Tubing
Welded Construction
Tolerance: ± 1/32"


Construction: Aluminum or Steel Weldment
Tolerance: ±.03 Two Places
±.005 Three Places
.25R (4 Places)
Clear Drill For
10-32 Screw
4 Places
.50 Dia.
.25R (4 Places)
.25
1.00
1.75
1.41
.72
1.375
2.81
3.000
3.50
.50
1.38
1.40


FORCE (lbs)
DISPLACEMENT (Inches)
0
10
20
30
40
50
60
70
80
90
0.25
0.50
0.75
1.00
1.30
88
73
63
50


Vertical Mating Surface of Skull
Parallel to the Vertical Backline
1.7″
Spacer (Ref.)
3° (Ref.)
.25″
Spacer (Ref.)
Arm
Elevation
Pivot
Shoulder Yoke Upper Surface
Horizontal and Centered at
Mid-Travel in Anterior-Pos-
Terior Director.
11.6″ (Ref.)
'H'Point
Tangent
Knee Pivot
Bolt
Lumbar—Pelvic Adaptor
Upper Surface Horizontal

Space for figures 12 thru 14 reserved for future use.

Subpart C—Three Year Old Child

§ 572.15 General description.

(a) The dummy consists of the component assemblies specified in drawing SA 103C 001, which are described in their entirety by means of approximately 122 drawings and specifications and an Operation and Maintenance Manual, dated May 28, 1976. The drawings and specifications are grouped by component assemblies under the following thirteen headings:

SA 103C 010	Head Assembly
SA 103C 020	Neck Assembly
SA 103C 030	Torso Assembly
SA 103C 041	Upper Arm Assembly Left
SA 103C 042	Upper Arm Assembly Right
SA 103C 051	Forearm Hand Assembly Left
SA 103C 052	Forearm Hand Assembly Right
SA 103C 061	Upper Leg Assembly Left
SA 103C 062	Upper Leg Assembly Right
SA 103C 071	Lower Leg Assembly Left
SA 103C 072	Lower Leg Assembly Right
SA 103C 081	Foot Assembly Left
SA 103C 082	Foot Assembly Right

(b) The drawings, specifications, and operation and maintenance manual referred to in this regulation that are not set forth in full are hearby incorporated in this Part by reference. These materials are thereby made part of this regulation. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the Code of Federal Regulations.

(c) The materials incorporated by reference are available for examination in Docket 78–09, Room 5109, Docket Section, National Highway Traffic Safety Administration, 400 Seventh Street S.W., Washington, D.C. 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C. 20005, ((202) 628–6667). The materials are also on file in the reference library of the Federal Register, National Archives and Records Administration, Washington, D.C.

(d) Adjacent segments are joined in a manner such that throughout the range of motion and also under simulated crash-impact conditions, there is no contact between metallic elements except for contacts that exist under static conditions.

(e) The structural properties of the dummy are such that the dummy conforms to this part in every respect both before and after being used in vehicle tests specified by Standard No. 213 of this chapter (§ 571.213).

(f) The patterns of all cast and molded parts for reproduction of the molds needed in manufacturing of the dummies can be obtained on a loan basis by manufacturers of the test dummies, or others if need is shown, from the Office of Vehicle Safety Standards, NHTSA, 400 Seventh Street S.W., Washington, D.C. 20590.

§ 572.16 Head.

(a) [The head consists of the assembly designated as SA 103C 010 on drawing no. SA 103C 001, and conforms to either—

(1) each item specified on drawing SA 103C 002(B), sheet 8; or

(2) each item specified on drawing SA 103C 002, sheet 8.

(b) When the head is impacted by a test probe specified in § 572.21(a)(1) at 7 fps., then the peak resultant acceleration measured at the location of the accelerometer mounted in the headform in according to § 572.21(b) is not less than 95g, and not more than 118g.

(1) The recorded acceleration-time curve for this test is unimodal at or above the 50g level, and lies at or above that level for intervals:

(i) in the case of the head assembly specified in paragraph (a)(1) of this section, not less than 1.3 milliseconds and not more than 2.0 milliseconds;

(ii) in the case of the head assembly specified in paragraph (a)(2) of this section, not less than 2.0 milliseconds and not more than 3.0 milliseconds.

(2) The lateral acceleration vector shall not exceed 7g. **(55 F.R. 30465—July 26, 1990. Effective: August 27, 1990)]**

(c) *Test Procedure:*

(1) Seat the dummy on a seating surface having a back support as specified in § 572.21(h) and orient the dummy in accordance with § 572.21(h) and adjust the joints of

the limbs at any setting between 1g and 2g, which just supports the limbs' weight when the limbs are extended horizontally forward.

(2) Adjust the test probe so that its longitudinal centerline is at the forehead at the point of orthogonal intersection of the head midsagittal plane and the transverse plane which is perpendicular to the "Z" axis of the head (longitudinal centerline of the skull anchor) and is located 0.6 ± .1 inches above the centers of the head center of gravity reference pins and coincides within 2 degrees with the line made by the intersection of horizontal and midsagittal planes passing through this point.

(3) Adjust the dummy so that the surface area on the forehead immediately adjacent to the projected longitudinal centerline of the test probe is vertical.

(4) Impact the head with the test probe so that at the moment of impact the probe's longitudinal centerline falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.

(5) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

(6) Allow a time period of at least 20 minutes between successive tests of the head.

§ 572.17 Neck.

[(a)(1) The neck for use with the head assembly described in § 572.16(a)(1) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002(B), sheet 9.

(2) The neck for use with the head assembly described in § 572.16(a)(2) consists of the assembly designated as SA 103C 020 on drawing No. SA 103C 001, and conforms to each item specified on drawing No. SA 103C 002, sheet 9. **(55 F.R. 30465—July 26, 1990. Effective: August 27, 1990)**]

Rotation (degrees)	Time (ms) ± (2 + .08T)	Chordal Displacement (inches ±0.8)
0	0	0
30	21	2.2
60	36	4.3
Maximum	62	5.8
60	91	4.3
30	108	2.2
0	123	0

(b) When the head-neck assembly is tested in accordance with paragraph (c) of this section, the head shall rotate in reference to the pendulum's longitudinal centerline a total of 84 degrees ± 8 degrees about its center of gravity, rotating to the extent specified in the following table at each indicated point in time, measured from impact, with the chordal displacement measured at its center of gravity. The chordal displacement at time T is defined as the straight line distance between (1) the position relative to the pendulum arm of the head center of gravity at time zero, and (2) the position relative to the pendulum arm of the head center of gravity at time T as illustrated by Figure 3. The peak resultant acceleration recorded at the location of the accelerometers mounted in the headform in accordance with § 572.21(b) shall not exceed 30g. The pendulum shall not reverse direction until the head's center of gravity returns to the original zero time position relative to the pendulum arm.

(c) *Test Procedure:*

(1) Mount the head and neck on a rigid pendulum as specified in Figure 4, so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal centerline. Mount the neck directly to the pendulum as shown in Figure 15.

(2) Release the pendulum and allow it to fall freely from a height such that the velocity at impact is 17.00 ± 1.0 feet per second (fps), measured at the center of the accelerometer specified in Figure 4.

(3) Decelerate the pendulum to a stop with an acceleration-time pulse described as follows:

(i) Establish 5g and 20g levels on the $a-t$ curve.

(ii) Establish t_1 at the point where the $a-t$ curve first crosses the 5g level, t_2 at the point where the rising $a-t$ curve first crosses the 20g level, t_3 at the point where the decaying $a-t$ curve last crosses the 20g level, and t_4 at the point where the decaying $a-t$ curve first crosses the 5g level.

(iii) t_2-t_1, shall be not more than 4 milliseconds.

(iv) t_3-t_2, shall be not less than 18 and not more than 21 milliseconds.

(v) t_4-t_3, shall be not more than 5 milliseconds.

(vi) The average deceleration between t_2 and t_3 shall be not less than 20g and not more than 34g.

(4) Allow the neck to flex without contact of the head or neck with any object other than the pendulum arm.

(5) Allow a time period of at least 1 hour between successive tests of the head and neck.

§ 572.18 Thorax.

(a) The thorax consists of the part of the torso shown in assembly drawing SA 103C 001 by number SA 103C 030 and conforms to each of the applicable drawings listed under this number on drawings SA 103C 002, sheets 10 and 11.

(b) When impacted by a test probe conforming to § 572.21(a) at 13 fps. in accordance with paragraph (c) of this section, the peak resultant accelerations at the location of the accelerometers mounted in the chest cavity in accordance with § 572.21(c) shall be not less than 50g and not more than 70g. The acceleration-time curve for the test shall be unimodal at or above the 30g level and shall lie at or above the 30g level for an interval not less than 2.5 milliseconds and not more than 4.0 milliseconds. The lateral acceleration shall not exceed 5g.

(c) *Test Procedure:*

(1) With the dummy seated without back support on a surface as specified in § 572.21(h) and oriented as specified in § 572.21(h), adjust the dummy arms and legs until they are extended horizontally forward parallel to the midsagittal plane, the joints of the limbs are adjusted at any setting between 1g and 2g, which just supports the limbs' weight when the limbs are extended horizontally forward.

(2) Establish the impact point at the chest midsagittal plane so that it is 1.5 inches below the longitudinal centerline of the bolt that attaches the top of the ribcage sternum to the thoracic spine box.

(3) Adjust the dummy so that the tangent plane at the surface on the thorax immediately adjacent to the designated impact point is vertical and parallel to the face of the test probe.

(4) Place the longitudinal centerline of the test probe to coincide with the designated impact point and align the test probe so that at impact its longitudinal centerline coincides within 2 degrees with the line formed by intersection of the horizontal and midsagittal planes passing through the designated impact point.

(5) Impact the thorax with the test probe so that at the moment of impact the probe's longitudinal centerline falls within 2 degrees of a horizontal line in the dummy midsagittal plane.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical or rotational movement.

(7) Allow a time period of at least 20 minutes between successive tests of the chest.

§ 572.19 Lumbar spine, abdomen and pelvis.

(a) The lumbar spine, abdomen, and pelvis consist of the part of the torso assembly shown by number SA 103C 030 on drawing SA 103C 001 and conform to each of the applicable drawings listed under this number on drawing SA 103C 002, sheets 10 and 11.

(b) When subjected to continuously applied force in accordance with paragraph (c) of this section, the lumbar spine assembly shall flex by an amount that permits the rigid thoracic spine to rotate from its initial position in accordance with Figure 18 of this subpart by 40 degrees at a force level of not less than 34 pounds and not more than 47 pounds, and straighten upon removal of the force to within 5 degrees of its initial position.

(c) *Test Procedure:* (1) The dummy with lower legs removed is positioned in an upright seated position on a seat as indicated in Figure 18, ensuring that all dummy component surfaces are clean, dry and untreated unless otherwise specified.

(2) Attach the pelvis to the seating surface by a bolt C/328, modified as shown in Figure 18, and the upper legs at the knee axial rotation joints by the attachments shown in Figure 18. Tighten the mountings so that the pelvis-lumbar joining surface is horizontal and adjust the femur ball-flange screws at each hip socket joint to 50 inch pounds torque. Remove the head and the neck and install a cylindrical aluminum adapter 2.0 inches in diameter and 2.80 inches long in place of the neck.

(3) Flex the thorax forward 50 degrees and then rearward as necessary to return to its initial position in accordance with Figure 18 unsupported by external means.

(4) Apply a forward pull force in the midsagittal plane at the top of the neck adapter,

so that at 40 degrees of the lumbar spine flexion the applied force is perpendicular to the thoracic spine box. Apply the force at any torso deflection rate between 0.5 and 1.5 degrees per second up to 40 degrees of flexion but no further; continue to apply for 10 seconds the force necessary to maintain 40 degrees of flexion, and record the highest applied force at that time. Release all force as rapidly as possible and measure the return angle 3 minutes after the release.

§ 572.20 Limbs.

The limbs consist of the assemblies shown on drawing SA 103C 001 as Nos. SA 103C 041, SA 103C 042, SA 103C 051, SA 103C 052, SA 103C 061, SA 103C 062, SA 103C 071,SA 103C 072, SA 103C 081, SA 103C 082, and conform to each of the applicable drawings listed under their respective numbers of the drawing SA 103C 002, sheets 12 through 21.

§ 572.21 Test conditions and Instrumentation.

[(a)(1) The test probe used for head and thoracic impact tests is a cylinder 3 inches in diameter, 13.8 inches long and weighs 10 lbs., 6 ozs. Its impacting end has a flat right face that is rigid and that has an edge radius of 0.5 inches.

(2) The head and thorax assembly may be instrumented with a Type A or Type C accelerometer.

(i) Type A accelerometer is defined in drawing SA–572 S1.

(ii) Type C accelerometer is defined in drawing SA–572 S2.

(b) *Head Accelerometers.* Install one of the triaxial accelerometers specified in § S72.21(a)(2) on a mounting block located on the horizontal transverse bulkhead as shown in the drawings subreferenced under assembly SA 103C 010 so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the head accelerometer reference point located at the intersection of a line connecting the longitudinal centerlines of the transfer pins in the side of the dummy head with the midsagittal plane of the dummy head.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with the midsagittal plane, with the seismic mass center located 0.2 inches dorsal to, and 0.1 inches inferior to the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane, perpendicular to the midagittal plane, with the seismic mass center located 0.1 inches inferior, 0.4 inches to the right of, and 0.9 inches dorsal to the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 inches inferior to, 0.6 inches dorsal to, and 0.4 inches to the right of the head accelerometer reference point.

(iv) All seismic mass centers are positioned with ±0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and coincident with midsagittal planes, with the seismic mass center located from 0.2 to 0.47 inches dorsal to, from 0.01 inches inferior to 0.21 inches superior, and from 0.0 to 0.17 inches left of the head accelerometer reference point.

(ii) Align the second sensitive axis with the horizontal plane perpendicular to the medsagittal plane, with the seismic mass center located 0.1 to 0.13 inches inferior to, 0.17 to 0.4 inches to the right of, and 0.47 to 0.9 inches dorsal of the head accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.1 inches inferior to, 0.6 inches dorsal to, and 0.4 inches to the right of the head accelerometer reference point.

(c) *Thorax Accelerometers.* Install one of the triaxial accelerometers specified in § 572.21(a)(2) on a mounting plate attached to the vertical transverse bulkhead shown in the drawing subreferenced under assembly NO. SA 103C 030 in drawing SA 103 001, so that the seismic mass centers of each sensing element are positioned as specified in this paragraph, relative to the thorax accelerometer reference point located in the midsagittal plane 3 inches above the top surface of the lumbar spine, 0.3 inches doral to the accelerometer mounting plate surface.

(1) The sensing elements of the Type C triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with seismic mass center located 0.2 inches to the left of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane, and perpendicular to the midsagittal plane, with the seismic mass center located 0.2 inches to the right of, 0.1 inches inferior to, and 0.2 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes with the seismic mass center located 0.2 inches superior to, 0.5 inches to the right of, and 0.1 inches ventral to the thorax accelerometer reference points. (iv) All seismic mass centers shall be positioned within ±0.05 inches of the specified locations.

(2) The sensing elements of the Type A triaxial accelerometer are aligned as follows:

(i) Align one sensitive axis parallel to the vertical bulkhead and midsagittal planes, with the seismic mass center located from 0.2 inches left to 0.28 inches right, from 0.5 to 0.15 inches inferior to, and from 0.15 to 0.25 inches ventral of the thorax accelerometer reference point.

(ii) Align the second sensitive axis so that it is in the horizontal transverse plane and perpendicular to the midsagittal plane, with the seismic mass center located from 0.06 inches left to 0.2 inches right of, from 0.1 inches inferior to 0.24 inches superior, and 0.15 to 0.25 inches ventral to the thorax accelerometer reference point.

(iii) Align the third sensitive axis so that it is parallel to the midsagittal and horizontal planes, with the seismic mass center located 0.15 to 0.25 inches superior to, 0.28 to 0.5 inches to the right of, and from 0.1 inches ventral to 0.19 inches dorsal to the thorax accelerometer reference point. **(55 F.R. 30465—July 26, 1990. Effective: August 27, 1990)]**

(d) The outputs of accelerometers installed in the dummy, and of test apparatus specified by this part, are recorded in individual data channels that conform to the requirements of SAE Recommended Practice J211a, December 1971, with channel classes as follows:

(1) Head acceleration—Class 1,000.

(2) Pendulum acceleration—Class 60.

(3) Thorax acceleration—Class 180.

(e) The mountings for accelerometers have no resonance frequency less than 3 times the cut-off frequency of the applicable channel class.

(f) Limb joints are set at the force between 1–2g, which just supports the limbs' weight when the limbs are extended horizontally forward. The force required to move a limb segment does not exceeed 2g throughout the range of limb motion.

(g) Performance tests are conducted at any temperature from 66° F to 78° F and at any relative humidity from 10 percent to 70 percent after exposure of the dummy to these conditions for a period of not less than 4 hours.

(h) For the performance tests specified §§ 572.16, 572.18, and 572.19, the dummy is positioned in accordance with Figures 16, 17, and 18 as follows:

(1) The dummy is placed on a flat, rigid, clean, dry, horizontal surface of teflon sheeting with a smoothness of 40 microinches and whose length and width dimensions are not less than 16 inches, so that the dummy's midsagittal plane is vertical and centered on the test surface. For head tests, the seat has a vertical back support whose top is 12.4 ± 0.2 inches above the seating surface. The rear surfaces of the dummy's shoulders and buttocks are touching the back support as shown in Figure 16. For thorax and lumbar spine tests, the seating surface is without the back support as shown in Figures 17 and 18 respectively.

(2) The shoulder yokes are adjusted so that they are at the midpoint of their anterior-posterior travel with their upper surfaces horizontal.

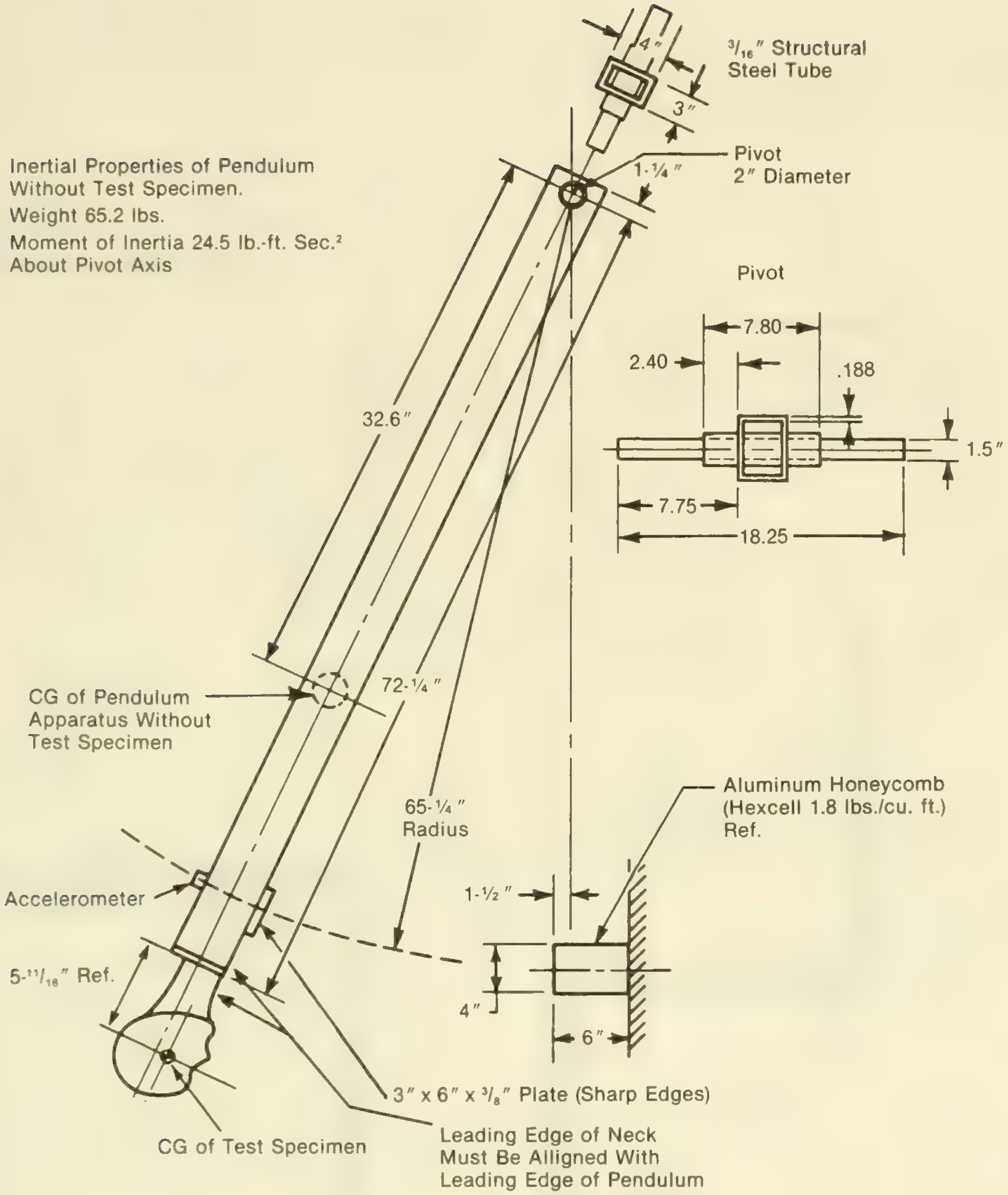
(3) The dummy is adjusted for head impact and lumbar flexion tests so that the rear surfaces of the shoulders and buttocks are tangent to a transverse vertical plane.

(4) The arms and legs are positioned so that their centerlines are in planes parallel to the midsagittal plane.

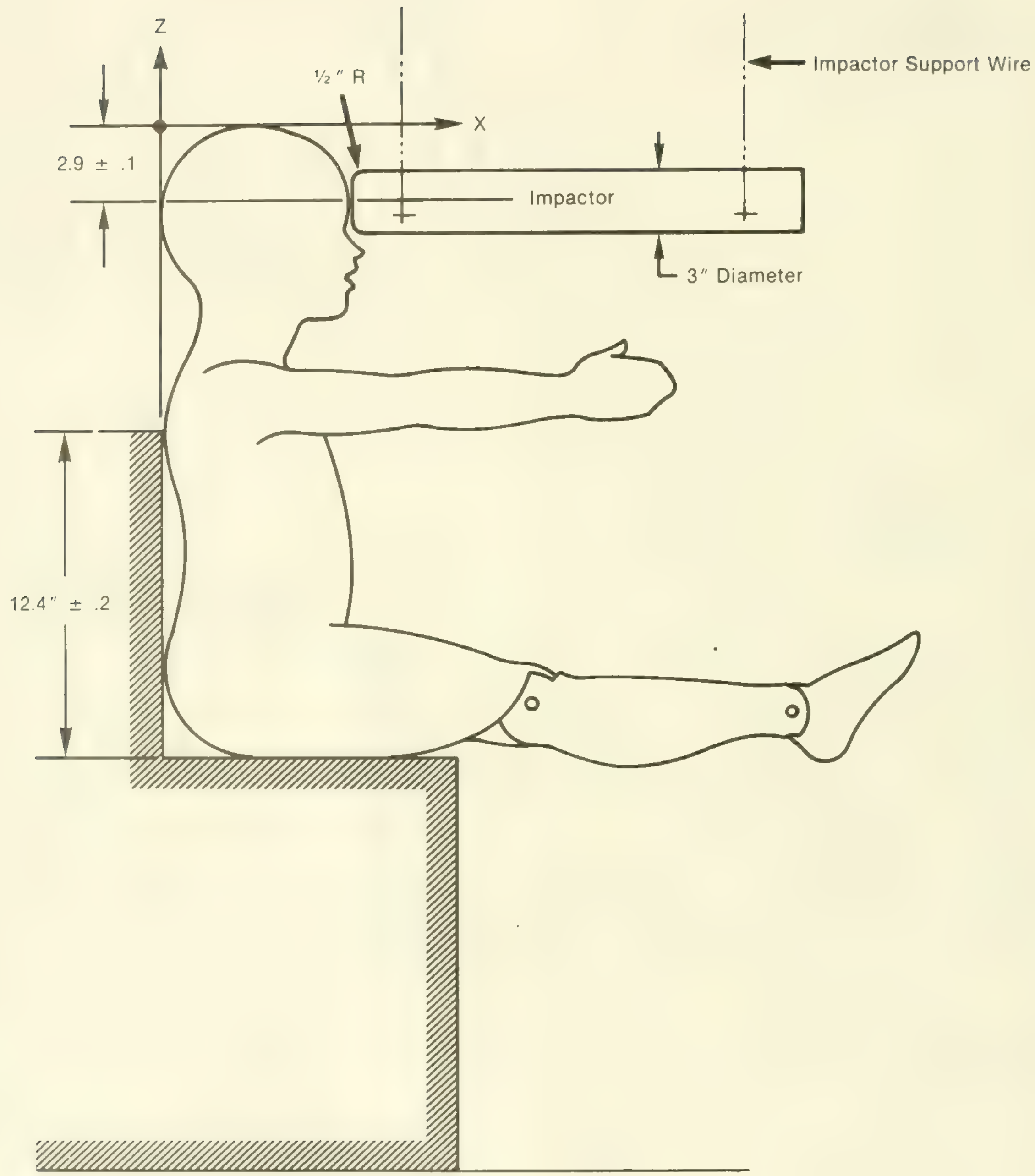
(i) The dummy's dimensions are specified in drawings No. SA 103C 002, sheets 22 through 26.

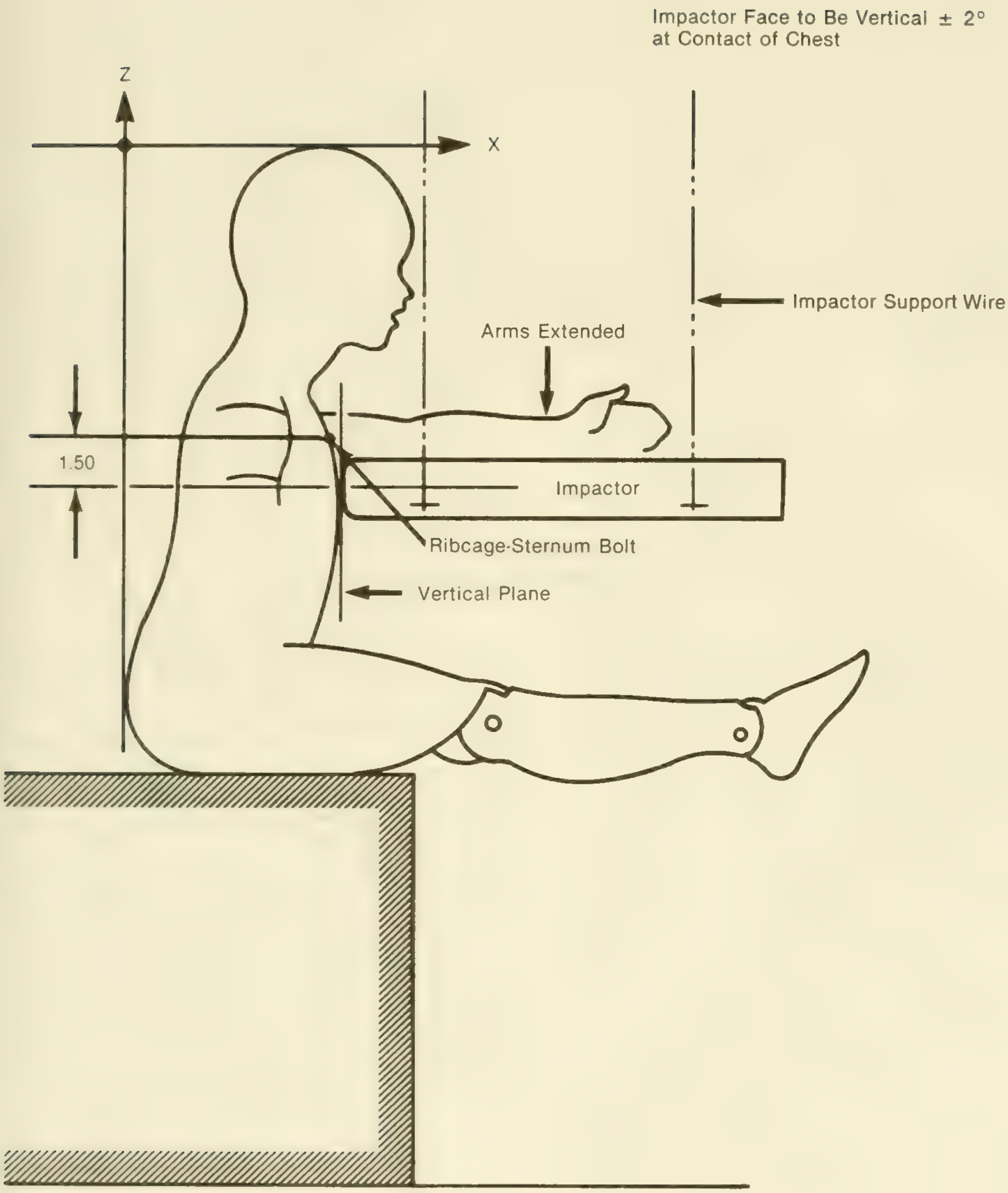
(j) Performance tests of the same component, segment, assembly or fully assembled dummy are separated in time by a period of not less than 20 minutes unless otherwise specified.

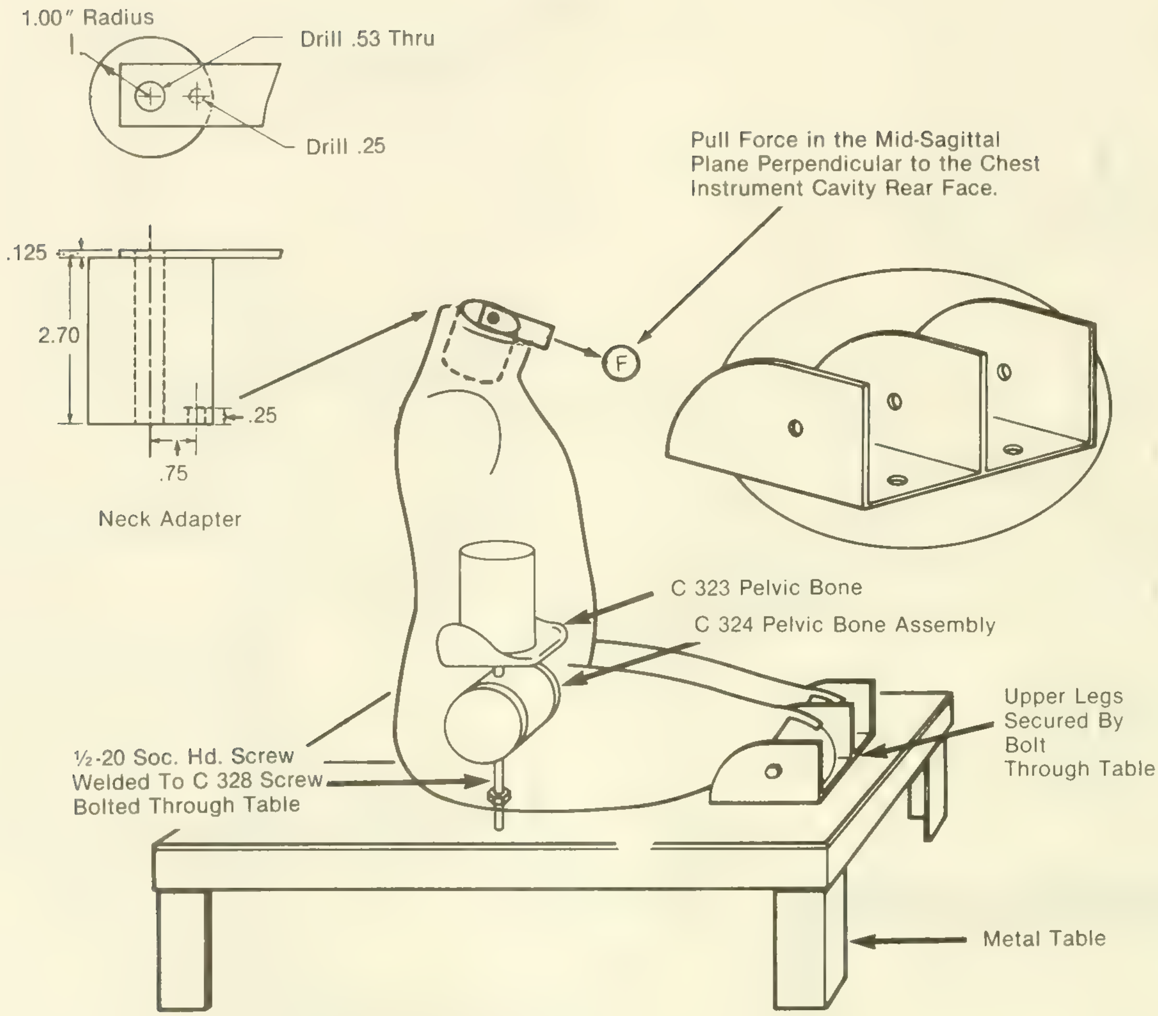
(k) Surfaces of the dummy components are not painted except as specified in this part or in drawings subtended by this part.



3/16" Structural Steel Tube
4"
3"
Pivot 2" Diameter
1-1/4"
Inertial Properties of Pendulum Without Test Specimen.
Weight 65.2 lbs.
Moment of Inertia 24.5 lb.-ft. Sec.²
About Pivot Axis
Pivot
7.80
2.40
.188
1.5"
7.75
18.25
32.6"
72-1/4"
CG of Pendulum Apparatus Without Test Specimen
65-1/4" Radius
Aluminum Honeycomb (Hexcell 1.8 lbs./cu. ft.) Ref.
Accelerometer
1-1/2"
5-11/16" Ref.
4"
6"
3" x 6" x 3/8" Plate (Sharp Edges)
CG of Test Specimen
Leading Edge of Neck Must Be Alligned With Leading Edge of Pendulum


Z
½″ R
X
Impactor Support Wire
2.9 ± .1
Impactor
3″ Diameter
12.4″ ± .2


Impactor Face to Be Vertical ± 2°
at Contact of Chest
Z
X
Impactor Support Wire
Arms Extended
1.50
Impactor
Ribcage-Sternum Bolt
Vertical Plane


1.00″ Radius
Drill .53 Thru
Drill .25
.125
2.70
.25
.75
Neck Adapter
Pull Force in the Mid-Sagittal Plane Perpendicular to the Chest Instrument Cavity Rear Face.
F
C 323 Pelvic Bone
C 324 Pelvic Bone Assembly
Upper Legs Secured By Bolt Through Table
½-20 Soc. Hd. Screw Welded To C 328 Screw Bolted Through Table
Metal Table

Subpart D—Six-Month-Old Infant

§ 572.25 General Description.

(a) The infant dummy is specified in its entirety by means of 5 drawings (No. SA 1001) and a construction manual, dated July 2, 1974, which describe in detail the materials and the procedures involved in the manufacturing of this dummy.

(b) The drawings, specifications, and construction manual referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. These materials are thereby made part of this regulation. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specifed in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader, the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the *Code of Federal Regulations*.

(c) The materials incorporated by reference are available for examination in Docket 78–09, Room 5109, Docket Section, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1111 14th Street, N.W., Washington, D.C. 20005, ((202) 628–6667 or 408–8789). The materials are also on file in the reference library of the Office of the Federal Register, National Archives and Records Administration , Washington, D.C.

(d) The structural properties of the dummy are such that the dummy conforms to this part in every respect both before and after being used in vehicle tests specified in Standard No. 213 of this chapter (§ 571.213).

Subpart E—Hybrid III Test Dummy

Source: 51 FR 26701, July 25, 1986, unless otherwise noted.

Effective Date Note and Optional Compliance Provisions: At 51 FR 26701, July 25,1986, Subpart E—Hybrid III Test Dummy was added, effective October 29, 1986. As of that date, manufacturers have the option of using either the Part 572 test dummy (Subpart B) or the Hybrid III test dummy until August 31, 1991. As of September 1, 1991, the Hybrid III will replace the Part 572 test dummy (Subpart B) and be used as the exclusive means of determining a vehicle's conformance with the performance requirements of Standard No. 208 (§ 571.208).

§ 572.30 Incorporated Materials.

(a) The drawings and specifications referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader, the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the *Code of Federal Regulations*.

(b) The materials incorporated in this part by reference are available for examination in the general reference section of Docket 79–04, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street, S.W., Washington, D.C. 20590. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C. 20005, ((202)628–6667). The drawings and specifications are also on file in the reference library of the Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

§ 572.31 General Description.

(a) The Hybrid III 50th percentile size dummy consists of components and assemblies specified in the Anthropomorphic Test Dummy drawings and specifications package which consists of the following six items:

(1) The Anthropomorphic Test Dummy Parts List, dated [March 10, 1988], and containing 13 pages, and Parts list Index, dated [March 10, 1988], containing [8] pages, **(57 F.R. 479009—October 14, 1992. Effective: October 14, 1992)**

(2) A listing of Optional Hybrid III Dummy Transducers, dated April 22, 1986, contain 4 pages.

(3) A General Motors Drawing package identified by GM drawing No. 78051–218 revision R and subordinate drawings.

(4) Disassembly, Inspection, Assembly and Limbs Adjustment Procedures for the Hybrid III Dummy, dated July 15, 1986,

(5) Sign Convention for the signal outputs of Hybrid III Dummy Transducers, dated July 15, 1986,

(6) Exterior Dimensions of the Hybrid III Dummy, dated July 15, 1986.

(b) The dummy is made up of the following component assemblies:

Drawing Number		*Revision*
78051–61	Head Assembly—Complete—	(T)
78051–90	Neck Assembly—Complete—	(A)
78051–89	Upper Torso Assembly—Complete—	(K)
78051–70	Lower Torso Assembly—Without Pelvic Instrumentation Assembly, Drawing Number 78051–59	(D)
86–5001–001	Leg Assembly—Complete (LH)—	(E)
86–5001–002	Leg Assembly—Complete (RH)—	(E)
78051–123	Arm Assembly—Complete (LH)—	(D)
78051–124	Arm Assembly—Complete (RH)—	(D)

(c) Any specifications and requirements set forth in this part supercede those contained in General Motors Drawing No. 78051–218, revision P.

(d) Adjacent segments are joined in a manner such that throughout the range of motion and also under crash-impact conditions, there is no contact between metallic elements except for contacts that exist under static conditions.

(e) The weights, inertial properties and centers of gravity location of component assemblies shall conform to those listed in drawing 78051–338, revision S.

(f) The structural properties of the dummy are such that the dummy conforms to this part in every respect both before and after being used in vehicle test specified in Standard No. 208 of this Chapter (S 571.208).

§ 572.32 Head.

(a) The head consists of the assembly shown in the drawing 78051–61, revision T, and shall conform to each of the drawings subtended therein.

(b) When the head (drawing 78051–61, revision T) with neck transducer structural replacement (drawing 78051–383, revision F) is dropped from a height of 14.8 inches in accordance with paragraph (c) of this section, the peak resultant accelerations at the location of the accelerometers mounted in the head in accordance with 572.36(c) shall not be less than 225g, and not more than 275g. The acceleration/time curve for the test shall be unimodal to the extent that oscillations occurring after the main acceleration pulse are less than ten percent (zero to peak) of the main pulse. The lateral acceleration vector shall not exceed 15g (zero to peak).

(c) *Test Procedure.* (1) Soak the head assembly in a test environment at any temperature between 66 degrees F to 78 degrees F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(2) Clean the head's skin surface and the surface of the impact plate with 1,1,1 Trichlorethane or equivalent.

(3) Suspend the head, as shown in Figure 19, so that the lowest point on the forehead is 0.5 inches below the lowest point on the dummy's nose when the midsagittal plane is vertical.

(4) Drop the head from the specified height by means that ensure instant release onto a rigidly supported flat horizontal steel plate, which is 2 inches thick and 2 feet square. The plate shall have a clean, dry surface and any microfinish of not less than 8 microinches (rms) and not more than 80 microinches (rms).

(5) Allow at least 2 hours between successive tests on the same head.

§ 572.33 Neck.

(a) The neck consists of the assembly shown in drawing 78051–90, revision A and conforms to each of the drawings subtended therein.

(b) When the neck and head assembly (consisting of the parts 78051–61, revision T; – 84; –90, revision A; –96; –98; –303, revision E; –305; –306; –307, revision X, which has a neck transducer (drawing 83–5001–008) installed in conformance with 572.36(d), is tested in accordance with paragraph (c) of this section, it shall have the following characteristics:

(1) *Flexion.* (i) Plane D, referenced in Figure 20, shall rotate between 64 degrees and 78 degrees, which shall occur between 57 milliseconds (ms) and 64 ms from time zero. In first rebound, the rotation of plane D shall cross 0 degrees between 113 ms and 128 ms.

(ii) The moment measured by the neck transducer (drawing 83–5001–008) about the occipital condyles, referenced in Figure 20,

shall be calculated by the following formula: Moment (lbs-ft) = My + 0.02875 × $F_{x'}$ where My is the moment measured in lbs-ft by the moment sensor of the neck transducer and Fx is the force measured in lbs by the x axis force sensor of the neck transducer. The moment shall have a maximum value between 65 lbs-ft occurring between 47 ms and 58 ms, and the positive moment shall decay for the first time to 0 lb-ft between 97 ms and 107 ms.

(2) *Extension.* (i) Plane D, referenced in Figure 21, shall rotate between 81 degrees and 106 degrees, which shall occur between 72 and 82 ms from time zero. In first rebound, the rotation of plane D shall cross 0 degree between 147 and 174 ms.

(ii) The moment measured by the neck transducer (drawing 83–5001–008) about the occipital condyles, referenced in Figure 21, shall be calculated by the following formula: Moment (lbs-ft) = My + 0.02875 × $F_{x'}$ where M is the moment measured in lbs-ft by the momensensor of the neck transducer and Fx is the force measure measured in lbs by the x axis force sensor of the neck transducer. The moment shall have a minimum value between −39 lbs-ft and −59 lbs-ft, which shall occur between 65 ms and 79 ms, and the negative moment shall decay for the first time to 0 lb-ft between 120 ms and 148 ms.

(3) Time zero is defined as the time of contact between the pendulum striker plate and the aluminum honeycomb material.

(c) *Test Procedure.* (1) Soak the test material in a test environment at any temperature between 69 degrees F to 72 degrees F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(2) Torque the jamnut (78051–64) on the neck cable (78051–301, revision E) to 1.0 lbs-ft ±. lbs-ft.

(3) Mount the head-neck assembly, defined in paragraph (b) of this section, on a rigid pendulum as shown in Figure 22 so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal axis.

(4) Release the pendulum and allow it to fall freely from a height such that the tangential velocity at the pendulum accelerometer centerline at the instance of contact with the honeycomb is 23.0 ft/sec ± 0.4 ft/sec. for fiexion testing and 19.9 ft/sec ± 0.4 ft/sec. for extension testing. The pendulum deceleration vs. time pulse for fiexion testing shall conform to the characteristics shown in Table A and the decaying deceleration-time curve shall first cross 5g between 34 ms and 42 ms. The penhe lm deceleration vs. time pulse for extension testing shall conform to the characteristics shown in Table B and the decaying deceleration-time curve shall cross 5g between 38 ms and 46 ms.

Table A

Flexion Pendulum Deceleration vs conme Pulse

Time (ms)	*Flesion deceleration level (g)*
10	22.50–27.50
20	17.60–22.60
30	12.50–18.50
Any other time above 30 ms	29 maximum

Table B

Extension Pendulum Deceleration vs. Time Pulse

Time (ms)	*Extension deceleration level (g)*
10	17.20–21.00
20	14.00–19.00
30	11.00–16.00
Any other time above 30 ms	22 maximum

(5) Allow the neck to flex without impact of the head or neck with any object during the ts on

§ 572.34 Thorax.

(a) The thorax cons at of the upper torso assembly in drawing 78051–89, revision [K] and shall conform to each of the drawings subtended therein.

(b) [When impacted by a test probe conforming to S 572.36(a) at 22 fps ± .40 fps in accordance with paragraph (c) ofd nos section, tthe horax of a complete dummy assembly (78051–218, Revision R) with left and right shoeg a 51–294 and –295) removed, shall resist with a force of 1242.5 pounds ± 82.5 pounds measured by the test probe and shall have a sternum displacement measured relativg a spine of 2.68 inches ± 0.18 inches. The internal hysteresis in each impact shall be more than 69% but less than 85%. The force measured is the product of pendulum mass and deceleration.] **(53 F.R. 8755—March 17, 1988. Effective: March 17, 1988)**

(c) *Test procedure*. (1) Soak the test dummy in an environment with a relative humidity from 10% to 70% until the temperature of the ribs of the test dummy have stabilized at a temperature between 69 degrees F and 72 degrees F.

(2) [Seat the dummy without back and arm supports on a surface as shown in Figure 23, and set the angle of the pelvic bone at 13 degrees plus or minus 2 degrees, using the procedure described in S 11.4.3.2 of Standard No. 208 (S 571.208 of this chapter).] **(53 F.R. 8755—March 17, 1988. Effective: March 17, 1988).**

(3) Place the longitudinal centerline of the test probe so that it is .5 in ± .04 in. below the horizontal centerline of the No. 3 Rib (reference drawin number 79051–64, revision A–M) as shown Figure 23.

(4) Align the test probe specified in S572.36(a) so that at impact it longitudinal centerline coincides within .5 degree of a horizontal line in the dummy's midsagittal plane.

(5) Impact the thorax with the test probe so that the longitudinal centerline of the test probe falls within 2 degrees of a horizontal line in the dummy's midsagittal plane at the moment of impact.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical, or rotational movement.

(7) Measure the horizontal deflection of the sternum relative to the thoracic spine along the line established by the longitudinal centerline of the probe at the moment of impact, using a potentiomeican(ref. drawing 78051–317, revision A) mounted inside thnuteernum as shown in drawing 78051–89, revision I.

(8) Measure hysteresis by determining the ratio of the area between the loading and unloading portions of the force deflection curve to the area under the loading portion of the curve.

§ 572.35 Limbs.

(a) The limbs consist of the following assemblies: leg assemblies 86–5001–001 and –002 and arm assemblies 78051–123, revision D, and –124, revision D, and shall conform to the drawings subtended therein.

(b) [When each knee of the leg assemblies is impacted, in accordance with paragraph (c) of this section, at 6.9 ft/sec ± 0.10 ft/sec., by the pendulum defined in S 572.36(b), the peak knee impact force, which is a product of pendulum mass and acceleration, shall have a minimum value of not less than 1060 pounds and a maximum value of not more than 1300 pounds.] **(53 F.R. 8755—March 17, 1988. Effective: March 17, 1988)**

(c) *Test Procedure*. (1) The test material consists of leg assemblies (86–5001–001) left and (–002) right with upper leg assemblies (78051–46) left and (78051–47) right removed. The load cell simulator (78051–319, revision A) is used to secure the knee cap assemblies (79051–16, revision B) as shown in Figure 24.

(2) Soak the test material in a test environment at any temperature between 66 degrees F to 78 degrees F and at a relative humidity from 10% to 70% for a period of at least four hours prior to its application in a test.

(3) Mount the test material with the leg assembly secured through the load cell simulator to a rigid surface as shown in Figure 24. No contact is permitted between the foot and any other exterior surfaces.

(4) Place the longitudinal centerline of the test probe so that at contact with the knee it is colinear within 2 degrees with the longitudinal centerline of the femur load cell simulator.

(5) Guide the pendulum so that there is no significant lateral, vertical or rotational movement at time zero.

(6) Impact the knee with the test probe so that the longitudinal centerline of the test probe at the instant of impact falls within .5 degrees of a horizontal line parallel to the femur load cell simulator at time zero.

(7) Time zero is defined as the time of contact between the test probe and the knee.

§ 572.36 Test Conditions and instrumentation.

(a) The test probe used for thoracic impact tests is a 6 inch diameter cylinder that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid and has an edge radius of 0.5 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(b) The test probe used for the knee impact tests is a 3 inch diameter cylinder that weighs 11 pounds including instrumentation. Its impacting

end has a flat right angle face that is rigid and has an edge radius of 0.2 inches. The test probe has an accelerometer mounted on the end opposite from impact with its sensitive axis colinear to the longitudinal centerline of the cylinder.

(c) Head accelerometers shall have dimensions, response characteristics and sensitive mass locations specified in drawing 78051–136, revision A or its equivalent and be mounted in the head as shown in drawing 78051–61, revision T, and in the assembly shown in drawing 78051–218, revision R.

(d) The neck transducer shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 83–5001–008 or its equivalent and be mounted for testing as shown in drawing 79051–63, revision W, and in the assembly shown in drawing 78051–218, revision R.

(e) The chest accelerometers shall have the dimensions, response characteristics, and sensitive mass locations specified in drawing 78051–136, revision A or its equivalent and be mounted as shown with adaptor assembly 78051–116, revision D for assembly into 78051–218, revision R.

(f) The chest deflection transducer shall have the dimensions and response characteristics specified in drawing 78051–342, revision A or equivalent and be mounted in the chest deflection transducer assembly 87051–317, revision A for assembly into 78051–218, revision R.

(g) The thorax and knee impactor accelerometers shall have the dimensions and characteristics of Endevco Model 7231c or equivalent. Each accelerometer shall be mounted with its sensitive axis colinear with the pendulum's longitudinal centerline.

(h) The femur load cell shall have the dimensions, response characteristics, and sensitive axis locations specified in drawing 78051–265 or its equivalent and be mounted in assemblies 78051–46 and –47 for assembly into 78051–218, revision R.

(i) The outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified by this part are recorded in individual data channels that conform to the requirements of SAE Recommended Practice J211, JUN 1980, ''Instrumentation for Impact Tests,'' with channel classes as follows:

(1) Head acceleration—Class 1000

(2) Neck force—Class 60

(3) Neck pendulum acceleration—Class 60

(4) Thorax and thorax pendulum acceleration—Class 180

(5) Thorax deflection—Class 180

(6) Knee pendulum acceleration—Class 600

(7) Femur force—Class 600

(j) Coordinate signs for instrumentation polarity conform to the sign convention shown in the document incorporated by § 572.31(a)(5).

(k) The mountings for sensing devices shall have no resonance frequency within range of 3 times the frequency range of the applicable channel class.

(l) Limb joints are set at lg, barely restraining the weight of the limb when it is extended horizontally. The force required to move a limb segment shall not exceed 2g throughout the range of limb motion.

(m) Performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 30 minutes unless otherwise noted.

(n) Surfaces of dummy components are not painted except as specified in this part or in drawings subtended by this part.

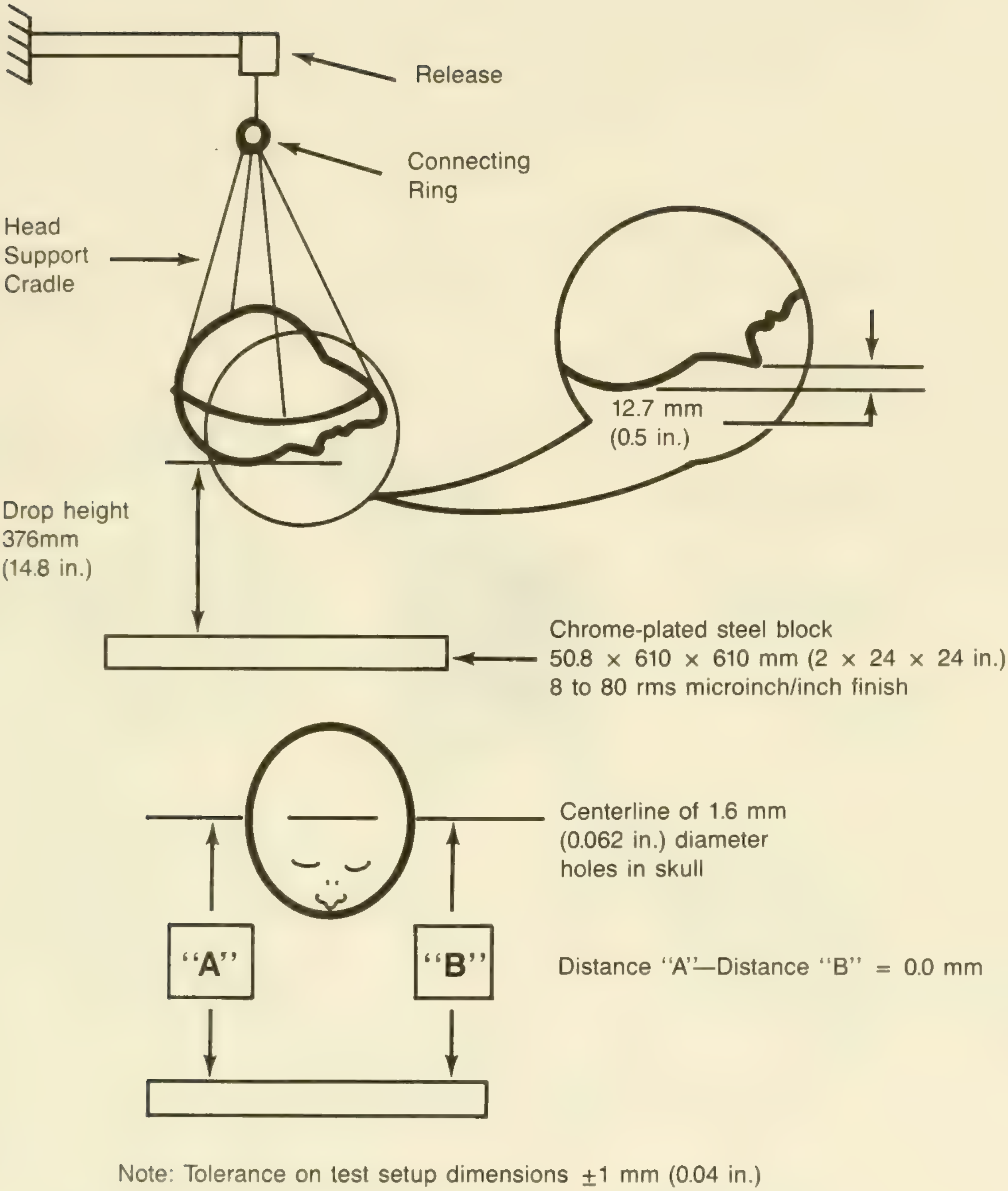


Figure 19. Test Set-up Specifications

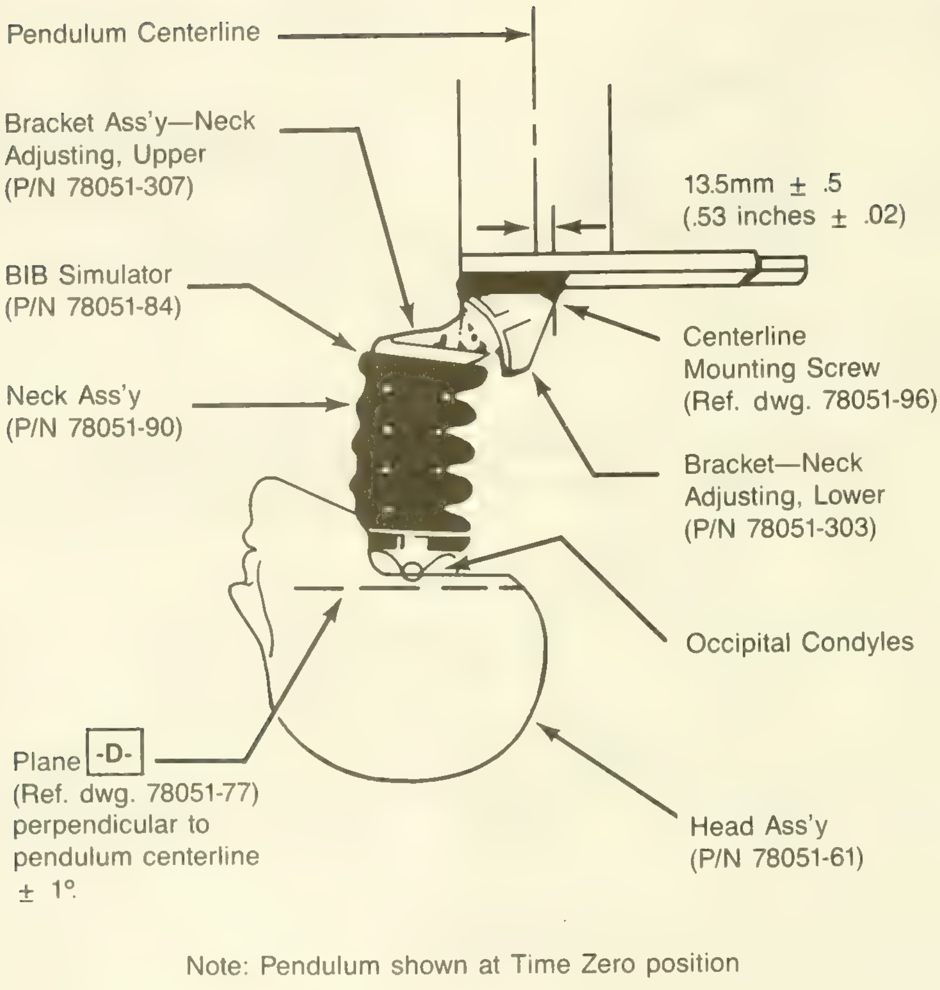
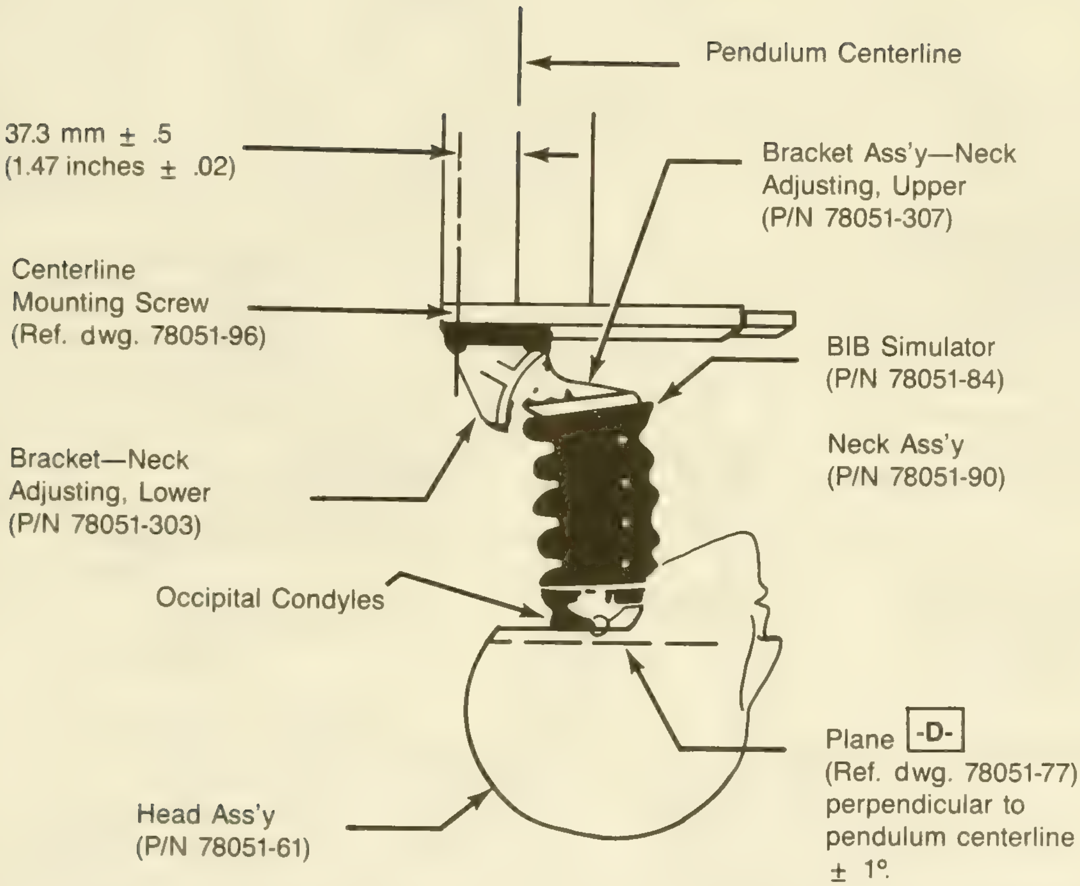


Figure 20. Flexion—Test Setup Specifications



Note: Pendulum shown at Time Zero position

Figure 21. Flexion—Test Setup Specifications

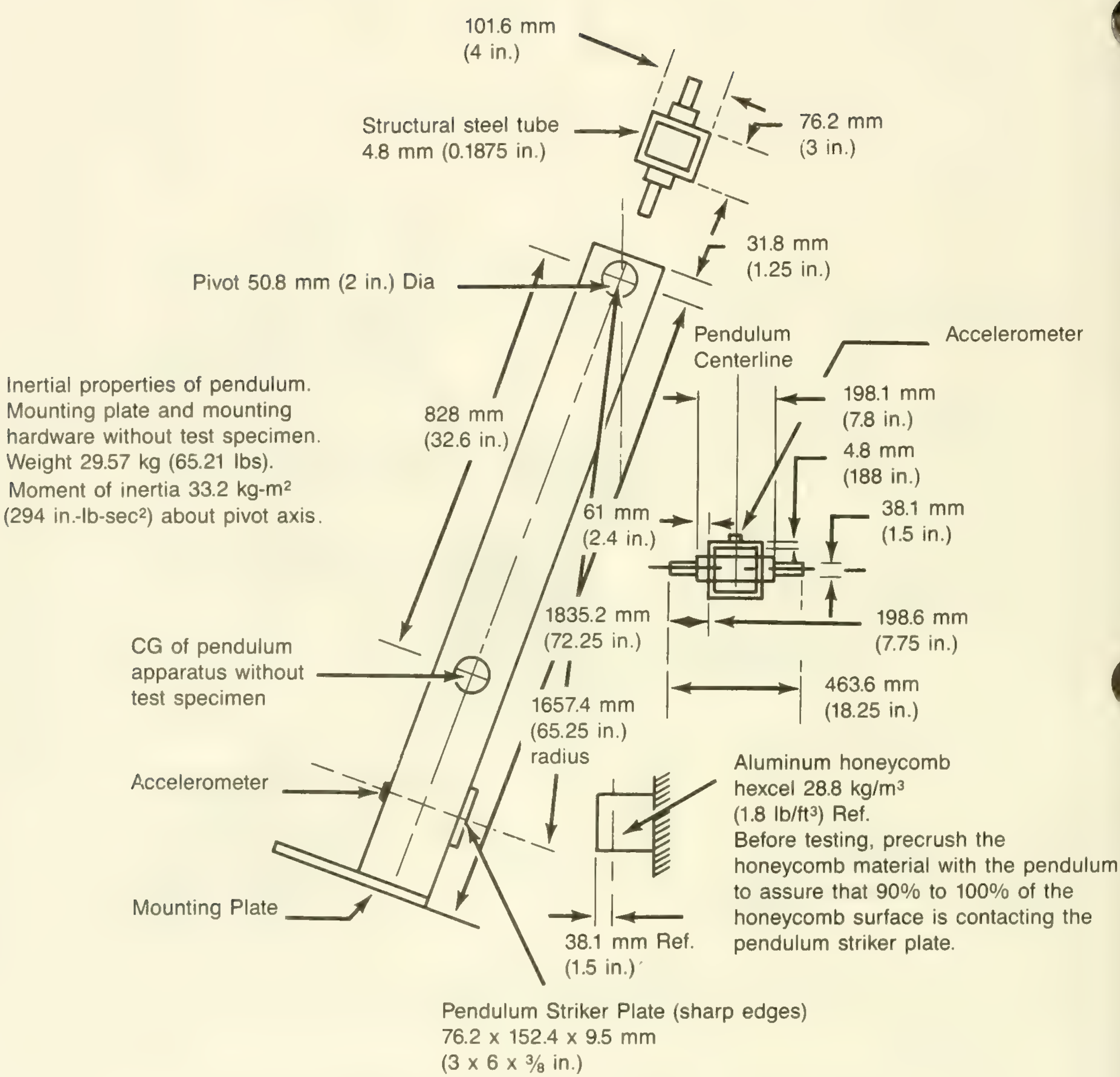
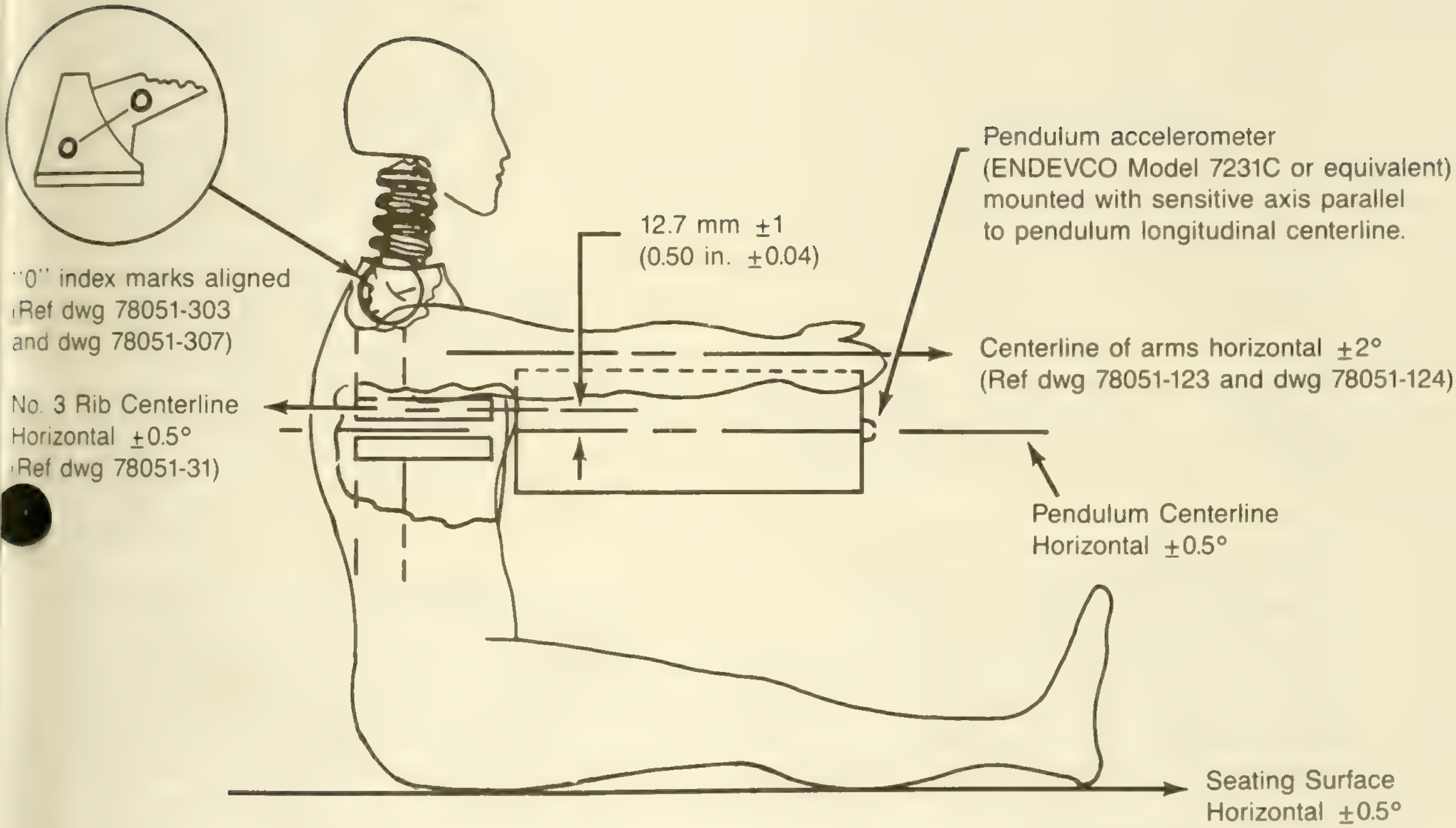


Figure 22. Pendulum Specifications



NOTE: A) No external support is required on the dummy to meet setup specifications.
B) The midsagittal plane of the dummy is vertical (±1°) and within 2° of the centerline of the pendulum.
C) The midsagittal plane of the dummy is centered on the centerline of the pendulum within 3 mm (0.12 in.).

Figure 23. Test Set-up Specifications

Subpart F—Side Impact Dummy 50th Percentile Male

[§ 572.40 Incorporated Materials.

(a) The drawings, specifications, and computer program referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. These materials are there by made part of this regulation. The Director of the Federal Register has approved the materials incorporated by reference. For materials subject to change, only the specific version approved by the Director of the Federal Register and specified in the regulation are incorporated. A notice of any change will be published in the *Federal Register*. As a convenience to the reader, the materials incorporated by reference are listed in the Finding Aid Table found at the end of this volume of the *Code of Federal Regulations*.

(b) The materials incorporated in this part by reference are available for examination in the general reference section of Docket 79–04, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street, S.W. Washington, D.C. Copies may be obtained from Rowley-Scher Reprographics, Inc., 1111 14th Street, N.W., Washington, D.C. 20005, telephone (202) 628–6667 or 408–8789.

[§ 572.41 General Description.

(a) The dummy consists of component parts and component assemblies (SA–SID–M001 and SA–SID–M001A) which are described in approximately 250 drawings and specifications that are set forth in Part 572.5(a) of this Chapter with the following changes and additions which are described in approximately 85 drawings and specifications:

(1) The head assembly consists of the assembly specified in Subpart B (§ 572.6(a)) and conforms to each of the drawings subtended under drawing SA 150 M 010 and drawings specified in SA–SID–M010 of this subpart.

(2) The neck assembly consists of the assembly specified in Subpart B (§ 572.7(a)) and conforms to each of the drawings subtended under drawing SA–150–M020 and drawings shown in SA–SID–M010.

(3) The thorax assembly consists of the assembly shown as number SID–053 and conforms to each applicable drawing subtended by number SA–SID–M030.

(4) The lumbar spine consists of the assembly specified in Subpart B (§ 572.9(a)) and conforms to drawing SA–150–M050 and drawings subtended by SA–SID–M050 specified by this part.

(5) The abdomen and pelvis consist of the assembly specified in Subpart B (§ 572.9) and conform to the drawings subtended by SA–150–M060 and drawings subtended by SA–SID–M060 specified by this Subpart.

(6) The lower limbs consist of the assemblies specified in Subpart B (§ 572.10) shown as SA–150–M080 and SA–150–M081 in Figure 1 and SA–SID–M080 and SA–SID–M081 and conform to the drawings subtended by those numbers.

(b) The structural properties of the dummy are such that the dummy conforms to the requirements of this subpart in every respect both before and after being used in vehicle tests specified in Standard No. 214 (Part 571.214 of this Chapter).

(c) Disassembly, inspection, and assembly procedures; external dimensions and weight; and a dummy drawing list are set forth in the Side Impact Dummy (SID) User's Manual, dated July 1990.

[§ 572.42 Thorax.

(a) When the thorax of a completely assembled dummy (SA–SID–M001A), appropriately assembled for right or left side impact, is impacted by a test probe conforming to § 572.44(a) at 14 fps in accordance with paragraph (b) of this section, the peak accelerations at the location of the accelerometers mounted on the thorax in accordance with § 572.44(b) shall be:

(1) for the accelerometer at the top of the Rib Bar on the struck side (LUR or RUR) not less than 37 g's and not more than 46 g's.

(2) for the accelerometer at the bottom of the Rib Bar on the struck side (LLR or RLR) not less than 37 g's and not more than 46 g's.

(3) for the lower thoracic spine (T12) not less than 15 g's and not more than 22 g's.

(b) *Test Procedure.* (1) Adjust the dummy legs as specified in § 572.44(f). Seat the dummy on a seating surface as specified in § 572.44(h) with the limbs extended horizontally forward.

(2) Place the longitudinal centerline of the test probe at the lateral side of the chest at the intersection of the centerlines of the third rib and the Rib Bar on the desired side of impact.

This is the left side if the dummy is to be used on the driver's side of the vehicle and the right side if the dummy is to be used on the passenger side of the vehicle. The probe's centerline is perpendicular to the thorax's midsagittal plane.

(3) Align the test probe so that its longitudinal centerline coincides with the line formed by the intersection of the transverse and frontal planes perpendicular to the chest's midsagittal plane passing through the designated impact point.

(4) Position the dummy as specified in § 572.44(h), so that the thorax's midsagittal plane and tangential plane to the Hinge Mounting Block (Drawing SID–034) are vertical.

(5) Impact the thorax with the test probe so that at the moment of impact at the designated impact point, the probe's longitudinal centerline falls within 2 degrees of a horizontal line perpendicular to the dummy's midsagittal plane and passing through the designated impact point.

(6) Guide the probe during impact so that it moves with no significant lateral, vertical or rotational movement.

(7) Allow a time period of at least 20 minutes between successive tests of the chest.

[§ 572.43 Lumbar spine and pelvis.

(a) When the pelvis of a fully assembled dummy (SA-SID-M001A) is impacted laterally by a test probe conforming to § 572.44(a) at 14 fps in accordance with paragraph (b) of this section, the peak accleration at the location of the accelerometer mounted in the pelvis cavity in accordance with § 572.44(c) shall be not less than 40g and not more han 60g. The acceleration-time curve for the test shall be unimodal and shall lie at or above the ±20g level for interval not less than 3 milliseconds and not more than 7 milliseconds.

(b) *Test Procedure.* (1) Adjust the dummy legs as specified in § 572.44(f). Seat the dummy on a seating surface as specified in § 572.44(h) with the limbs extended horizontally forward.

(2) Place the longitudinal centerline of the test probe at the lateral side of the pelvis at a point 3.9 inches vertical from the seating surface and 4.8 inches ventral to a transverse vertical plane which is tangent to the back of the dummy's buttocks.

(3) Align the test probe so that at impact its longitudinal centerline coincides with the line formed by intersection of the horizontal and vertical planes perpendicular to the midsagittal plane passing through the designated impact point.

(4) Adjust the dummy so that its midsagittal plane is vertical and the rear surfaces of the throa and buttocks are tangent to a transverse vertical plane.

(5) Impact the pelvis with the test probe so that at the moment of imact the probe's longitudinal centerline falls within 2 degrees of the line specified in (3) above.

(6) Guide the test probe during impact so that it moves with no significant lateral, vertical or rotational movement.

(7) Allow a time period of at least 2 hours between successive tests of the pelvis.

[§ 572.44 Instrumentation and test conditions.

(a) The test probe used for lateral thoracic and pelvis impact tests is a 6 inch diameter cylinder that weighs 51.5 pounds including instrumentation. Its impacting end has a flat right angle face that is rigid hand has an edge radius of 0.5 inches.

(b) Three accelerometers are mounted in the thrax for measurement of lateral accelerations with each accelerometer' s sensitive axis aligned to be closely perpendicular to the thorax's midsagittal plane. The accelerometers are mounted in the following locations:

(1) One accelerometer is mounted on the Thorax to Lumbar Adaptor (SID–005) by means of a T12 Accelerometer Mounting Platform (SID–009) and T12 Accelerometer Mount (SID–038) with its seismic mass center at any distance up to 0.4 inches from a surface point on the Thorax to Lumbar Adaptor where two perpendicular planes aligned with the adaptor's vertical and horizontal center lines intersect.

(2) Two accelerometers are mounted, one on the top and the other at the bottom part of the Rib Bar (SID–024) on the struck side. Their seismic mass centers are at any distance up to .4 inches from a point on the Rib Bar surface located on its longitudinal center line .75 inches from the top for the top accelerometer and .75 inches from the bottom, for the bottom accelerometer.

(c) One accelerometer is mounted in the pelvis for measurement of the lateral acceleration with its sensitive axis perpendicular to the pelvic midsagittal plane. The accelerometer is mounted on the rear wall of the instrument cavity (Drawing SID–087), with its seismic mass center located from a point 0.9 inches upward and 0.5 inches to the left of the mounting bolt centerline and 0.4 to 0.5 inches rearward of the rear wall of the instrument cavity.

(d) Instrumention and sensors used must conform to the SAE J–211 (1980) recommended practice requirements. The outputs of the accelerometers installed in the dummy are them processed with the software for the Finite Impulse Response (FIR) filter (FIR 100 software). The FORTRAN program for this FIR 100 software (FIR100 Filter Program, Version 1.0, July 16, 1990) is incorporated by reference in this Part. The data are processed in the following manner:

(1) Analong data recorded in accordance with SAE J–211 (1980) recommended practice channel class 1000 specification.

(2) Filter the data with a 300 Hz, SAE Class 180 filter;

(3) Subsample the data to a 1600 Hz sampling rate;

(4) Remove the bias from the subsampled data, and;

(5) Filter the data with the FIR100 Filter Program (Version 1.0, July 16, 1990), which has the following characteristics—

(A) Passband frequency, 100 Hz.

(B) Stopband frequency, 189 Hz.

(C) Stopband gain, −50db.

(D) Passband ripple, 0.0225 db.

(e) The mountings for the spine, rib and pelvis accelerometers shall have no resonance frequency within a range of 3 times the frequency range of the applicable channel class.

(f) Limb joints of the test dummy are set at the force between 1–2 g's, which just supports the limbs' weight when the limbs are extended horizontally forward. The force required to move a limb segment does not exceed 2 g's throughout the range of limb motion.

(g) Performance tests are conducted at any temperature from 66° F to 78° F and at any relative humidity from 10 percent to 70 percent after exposure of the dummy to these conditions for a period of not less than 4 hours.

(h) For the performance of tests specified in §§ 572.42 and 572.43, the dummy is positioned as follows:

(1) The dummy is placed on a flat, rigid, clean, dry, horizontal smooth aluminum surface whose length and width dimensions are not less than 16 inches, so that the dummy's midsagittal plane is vertical and centered on the test surface. The dummy's torso is positioned to meet the requirements of § 572.42 and § 572.43. The seating surface is without the back support and the test dummy is positioned so that the dummy's midsagittal plane is vertical and centered on the seat surface.

(2) The legs are positioned so that their centerlines are in planes parallel to the midsagittal plane.

(3) Performance pre-tests of the assembled dummy are separated in time by a period of not less than 20 minutes unless otherwise specified.

(4) Surfaces of the dummy components are not painted except as specified in this part or in drawings subtended by this part. **(55 F.R. 45757—October 30, 1990. Effective: November 29, 1990)]**

Subpart G [Reserved]

Subpart H [Reserved]

Subpart I—6-Year-Old Child

[§ 572.70 Incorportation by reference.

The drawings and specifications referred to in §§ 572.71(a) and 572.71(b) are hereby incorporated in Subpart I by reference. These materials are thereby made part of this regulation. The Director of the Federal Register approved the materials incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the materials may be inspected at NHTSA's Docket Section, 400 Seventh Street, S.W., Room 5109, Washington, D.C. or at the Office of the Federal Register, 1100 L St., N.W., Room 8401, Washington, D.C.

The incorporated material is available as follows:

(1) Drawing number SA 106C 001, sheets 1 through 18, and the drawings listed in the parts lists described on sheets 8 through 17, are available from Reprographic Technologies, 1111 14th Street, N.W., Washington, D.C. 20005, (202) 628–6667.

(2) A User's Manual entitled, "Six-Year-Old Size Child Test Dummy SA 106C," October 28, 1991, is available from Reprographic Technologies at the address in paragraph (1) of this section.

(3) SAE Recommended Practice J211, *Instrumentation for Impact Test,* June 1988, is available from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096–0001.

[§ 572.71 General description.

(a) The representative 6-year-old dummy consists of a drawings and specifications package that contains the following materials:

(1) Technical drawings and specifications package SA 106C 001, containing drawing number SA 106 C001 sheets 1 through 18, and the drawings listed in the parts lists described on sheets 8 through 17; and,

(2) A user's manual entitled, "Six-Year-Old Size Child Test Dummy SA 106C," October 28,1991.

(b) The dummy is made up of the component assemblies set out in the following Table A:

Table A

	Drawing Title
SA 106C 010	Head Assembly
SA 106C 020	Neck Assembly
SA 106C 030	Thorax Assembly
SA 106C 041	Arm Assembly (Right Arm)
SA 106C 042 (also includes picture of assembled parts)	Arm Assembly (Left Arm)
SA 106C 050	Lumbar Spine Assembly
SA 106C 060 (also includes picture of assembled parts)	Pelvis Assembly
SA 106C 071	Leg Assembly (Right Leg)
SA 106C 072 (also includes picture of assembled parts)	Leg Assembly (Left Leg)

(c) Adjacent segments are joined in a manner such that except for contacts existing under static conditions, there is no contact between metallic elements throughout the range of motion or under simulated crash-impact conditions.

(d) The structural properties of the dummy are such that the dummy conforms to this Part in every respect both before and after its use in any test similar to those specified in Standard 213. Child Restraint Systems.

[§ 572.72 Head assembly and test procedure.

(a) *Head assembly.* The head consists of the assembly designated as SA 106C 010 on drawing No. SA 106C 001, sheet 2, and conforms to each drawing listed on 8A 106C 001, sheet 8.

(b) *Head assembly impact response requirements.* When the head is impacted by a test probe conforming to § 572.77(a)(1) at 7 feet per second (fps) according to the test procedure in paragraph (c) of this section, then the resultant head acceleration measured at the location of the accelerometer installed in the headform according to § 577.77(b) is not less than 130g and not more than 160g.

(1) The recorded acceleration-time curve for this test is unimodal at or above the 50g level, and lies at or above that level for an interval not less than 1.0 and not more than 2.0 milliseconds.

(2) The lateral acceleration vector does not exceed 5g.

(c) *Head test procedure.* The test procedure for the head is as follows:

(1) Seat and orient the dummy on a seating surface having a back support as specified in § 572.78(c), and adjust the joints of the limbs at any setting (between 1g and 2g) which just supports the limbs' weight when the limbs are extended horizontally and forward.

(2) Adjust the test probe so that its longitudinal centerline is—

(i) At the forehead at the point of orthogonal intersection of the head midsagittal plane and the transverse plane which is perpendicular to the Z axis of the head as shown in Figure 40;

(ii) Located 2.7 ± 0.1 inches below the top of the head measured along the Z axis; and

(iii) Coincides within 2 degrees with the line made by the intersection of the horizontal and midsagittal planes passing through this point.

(3) Impact the head with the test probe so that at the moment of contact the probe's longitudinal center line falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.

(4) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement.

(5) Allow at least 60 minutes between successive head tests.

[§ 572.73 Neck assembly and test procedure.

(a) *Neck assembly.* The neck consists of the assembly designated as SA 106C 020 on drawing

SA 106C 001, sheet 2, and conforms to each drawing listed on SA 106C 001, sheet 9.

(b) *Neck assembly impact response requirements.* When the head-neck assembly (SA 106C 010 and SA 106C 020) is tested according to the test procedure in § 572.73(c), the head:

(1) Shall rotate, while translating in the direction of the pendulum preimpact flight, in reference to the pendulum's longitudinal center line a total of 78 degrees ± 6 degrees about the head's center of gravity; and

(2) Shall rotate to the extent specified in Table B at each indicated point in time, measured from time of impact, with the chordal displacement measured at the head's center of gravity.

(i) Chordal displacement at time "T" is defined as the straight line distance between the position relative to the pendulum arm of the head's center of gravity at time "zero;" and the position relative to the pendulum arm of the head's center of gravity at time T as illustrated by Figure 3 in § 572.11.

(ii) The peak resultant acceleration recorded at the location of the accelerometers mounted in the headform according to § 572.77(b) shall not exceed 30g.

Table B

Rotation (degrees)	*Time (ms)* ± (2 ± .08T)	*Chordal displacement (inches)* ±0.8
0	0	0
30	26	2.7
60	44	4.3
Maximum	68	5.8
60	101	4.4
30	121	2.4
0	140	0

(3) The pendulum shall not reverse direction until the head's center of gravity returns to the original "zero" time position relative to the pendulum arm.

(c) *Neck test procedure.* The test procedure for the neck is as follows:

(1) Mount the head and neck assembly on a rigid pendulum as specified in § 572.21, Figure 15, so that the head's midsagittal plane is vertical and coincides with the plane of motion of the pendulum's longitudinal center line. Attach the neck directly to the pendulum as shown in § 572.21, Figure 15.

(2) Release the pendulum and allow it to fall freely from a height such that the velocity at impact is 17 ± 1 fps, measured at the center of the accelerometer specified in § 572.21, Figure 15.

(3) Decelerate the pendulum to a stop with an acceleration-time pulse described as follows:

(i) Establish 5g and 20g levels on the a − t curve.

(ii) Establish t_1 at the point where the rising a − t curve first crosses the 5g level, t_2 at the point where the rising a − t curve first crosses the 20g level, t_3 at the point where the decaying a − t curve last crosses the 20g level, and t_4 at the point where the decaying a − t curve first crosses the 5g level.

(iii) $t_2 - t_1$ shall not be more than 3 milliseconds.

(iv) $t_3 - t_2$ shall not be more than 22 milliseconds, and not less than 19 milliseconds.

(v) $t_4 - t_3$ shall not be more than 6 milliseconds.

(vi) The average deceleration between t_2 and t_3 shall not be more than 26g, or less than 22g.

(4) Allow the neck to flex without the head or neck contacting any object other than the pendulum arm.

(5) Allow at least 60 minutes between successive tests.

[§ 572.74 Thorax assembly and test procedure.

(a) *Thorax assembly.* The thorax consists of the part of the torso assembly designated as SA 106C 030 on drawing SA 106C 001, sheet 2, and conforms to each applicable drawing on SA 106C 001, sheets 10 and 11.

(b) *Thorax assembly requirements.* When the thorax is impacted by a test probe conforming to § 572.77(a) at 20 ± 0.3 fps according to the test procedure in paragraph (c) of this section, the peak resultant accelerations at the accelerometers mounted in the chest cavity according to § 572.77(c) shall not be less than 43g and not more than 53g.

(1) The recorded acceleration-time curve for this test shall be unimodal at or above the 30g level, and shall lie at or above that level for an interval not less than 4 milliseconds and not more than 6 milliseconds.

(2) The lateral acceleration shall not exceed 5g.

(c) *Thorax test procedure.* The test procedure for the thorax is as follows:

(1) Seat and orient the dummy on a seating surface without back support as specified in § 572.78(c), and adjust the joints of the limbs at any setting (between 1g and 2g) which just supports the limbs' weight when the limbs are extended horizontally and forward, parallel to the midsagittal plane.

(2) Establish the impact point at the chest midsagittal plane so that the impact point is 2.25 inches below the longitudinal center of the clavicle retainer screw, and adjust the dummy so that the longitudinal center line of the No. 3 rib is horizontal.

(3) Place the longitudinal center line of the test probe so that it coincides with the designated impact point, and align the test probe so that at impact, the probe's longitudinal center line coincides (within 2 degrees) with the line formed at the intersection of the horizontal and midsagittal planes and passes through the designated impact point.

(4) Impact the thorax with the test probe so that at the moment of contact the probe's longitudinal center line falls within 2 degrees of a horizontal line in the dummy's midsagittal plane.

(5) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement.

(6) Allow at least 30 minutes between successive tests.

[§ 572.75 Lumbar spine, abdomen, and pelvis assembly and test procedure.

(a) *Lumbar spine, abdomen, and pelvis assembly.* The lumbar spine, abdomen, and pelvis consist of the part of the torso assembly designated as SA 106C 050 and 060 on drawing SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 12 and 13.

(b) *Lumbar spine, abdomen, and pelvis assembly response requirements.* When the lumbar spine is subjected to a force continuously applied according to the test procedure set out in paragraph (c) of this section, the lumbar spine assembly shall—

(1) Flex by an amount that permits the rigid thoracic spine to rotate from the torso's initial position, as defined in (c)(3), by 40 degrees at a force level of not less than 46 pounds and not more than 52 pounds, and

(2) Straighten upon removal of the force to within 5 degrees of its initial position when the force is removed.

(c) *Lumbar spine, abdomen, and pelvis test procedure.* The test procedure for the lumbar spine, abdomen, and pelvis is as follows:

(1) Remove the dummy's head-neck assembly, arms, and lower legs, clean and dry all component surfaces, and seat the dummy upright on a seat as specified in Figure 42.

(2) Adjust the dummy by—

(i) Tightening the femur ballflange screws at each hip socket joint to 50 inch-pounds torque;

(ii) Attaching the pelvis to the seating surface bv a bolt D/605 as shown in Figure 42;

(iii) Attaching the upper legs at the knee joints by the attachments shown in drawing Figure 42;

(iv) Tightening the mountings so that the pelvis-lumbar joining surface is horizontal; and

(v) Removing the head and neck, and installing a cylindrical aluminum adapter (neck adapter) of 2 inches diameter and 2.6 inches length as shown in Figure 42.

(3) The initial position of the dummy's torso is defined by the plane formed by the rear surfaces of the shoulders and buttocks which is 3 to 7 degrees forward of the transverse vertical plane.

(4) Flex the thorax forward 50 degrees and then rearward as necessary to return the dummy to its initial torso position, unsupported by external means.

(5) Apply a forward pull force in the midsagittal plane at the top of the neck adapter so that when the lumbar spine flexion is 40 degrees, the applied force is perpendicular to the thoracic spine box.

(i) Apply the force at any torso deflection rate between 0.5 and 1.5 degrees per second, up to 40 degrees of flexion.

(ii) For 10 seconds, continue to apply a force sufficient to maintain 40 degrees of flexion, and record the highest applied force during the 10 second period.

(iii) Release all force as rapidly as possible, and measure the return angle 3 minutes after the release.

[§ 572.76 Limbs assembly and test procedure.

(a) *Limbs assembly.* The limbs consist of the assemblies designated as SA 106C 041, SA 106C 042, SA 106C 071, and SA 106C 072, on drawing No. SA 106C 001, sheet 2, and conform to each applicable drawing listed on SA 106C 001, sheets 14 through 17.

(b) *Limbs assembly impact response requirement.*

When each knee is impacted at 7 ± 0.1 fps, according to paragraph (c) of this section, the maximum force on the femur shall not be more than 1060 pounds and not less than 780 pounds, with a duration above 400 pounds of not less than 0.8 milliseconds.

(c) *Limbs test procedure.* The test procedure for the limbs is as follows:

(1) Seat and orient the dummy without back support on a seating surface that is 11 ± 0.2 inches above a horizontal (floor) surface as specified in § 572.78(c).

(i) Orient the dummy as specified in Figure 43 with the hip joint adjustment at any setting between 1g and 2g.

(ii) Place the dummy's legs in a plane parallel to the dummy's midsagittal plane with the knee pivot center line perpendicular to the dummy's midsagittal plane, and with the feet flat on the horizontal (floor) surface.

(iii) Adjust the feet and lower legs until the line between the midpoint of each knee pivot and each ankle pivot is within 2 degrees of the vertical.

(2) If necessary, reposition the dummy so that at the level 1 inch below the seating surface, the not less than 3 inches and not more than 6 inches forward of the forward edge of the seat.

(3) Align the test probe specified in § 572.77(a) with the longitudinal center line of the femur force gauge, so that at impact, the probe's longitudinal center line coincides with the sensor's longitudinal center line within ±2 degrees.

(4) Impact the knee with the test probe moving horizontally and parallel to the midsagittal plane at the specified velocity.

(5) Guide the test probe during impact so that there is no significant lateral, vertical, or rotational movement.

[§ 572.77 Instrumentation.

(a)(1) *Test probe.* For the head, thorax, and knee impact test, use a test probe that is rigid, of uniform density, and weighs 10 pounds and 6 ounces, with a diameter of 3 inches; a length of 13.8 inches; and an impacting end that has a rigid flat right face and edge radius of 0.5 inches.

(2) The head and thorax assembly may be instrumented either with a Type A or Type B accelerometer.

(i) Type A accelerometer is defined in drawing SA 572 S1.

(ii) Type B accelerometer is defined in drawing SA 572 S2.

(b) *Head accelerometers.* Install accelerometers in the head as shown in drawing SA 106C 001, sheet 1, using suitable spacers or adaptors as needed to affix them to the horizontal transverse bulkhead so that the sensitive axes of the three accelerometers intersect at the point in the midsagittal plane located 0.4 inches below the intersection of a line connecting the longitudinal center lines of the roll pins in either side of the dummy's head with the head's midsagittal plane.

(1) The head has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is perpendicular to the horizontal bulkhead in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the horizontal bulkhead, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is parallel to the horizontal bulkhead in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches from the axial intersection point.

(c) *Thoracic accelerometers.* Install accelerometers in the thoracic assembly as shown in drawing SA 106C 001, sheet 1, using suitable spacers and adaptors to affix them to the frontal surface of the spine assembly so that the sensitive axes of the three accelerometers intersect at a point in the midsagittal plane located 0.95 inches posterior of the spine mounting surface, and 0.55

inches below the horizontal centerline of the two upper accelerometer mount attachment hole centers.

(1) The sternum-thoracic assembly has three orthogonally mounted accelerometers aligned as follows:

(i) Align one accelerometer so that its sensitive axis is parallel to the attachment surface in the midsagittal plane.

(ii) Align the second accelerometer so that its sensitive axis is parallel to the attachment surface, and perpendicular to the midsagittal plane.

(iii) Align the third accelerometer so that its sensitive axis is perpendicular to the attachment surface in the midsagittal plane.

(iv) The seismic mass center for any of these accelerometers may be at any distance up to 0.4 inches of the axial intersection point.

(d) *Femur-sensing device.* Install a force-sensing device SA 572 S10 axially in each femur shaft as shown in drawing SA 106C 072 and secure it to the femur assembly so that the distance measured between the center lines of two attachment bolts is 3 inches.

(e) *Limb joints.* Set the limb joints at 1g, barely restraining the limb's weight when the limb is extended horizontally, and ensure that the force required to move the limb segment does not exceed 2g throughout the limb's range of motion.

(f) *Recording outputs.* Record the outputs of acceleration and force-sensing devices installed in the dummy and in the test apparatus specified in this Part, in individual channels that conform to the requirements of SAE Recommended Practice J211, October 1988, with channel classes as set out in the following Table C.

Table C

Device	Channel
Head acceleration	Class 1000
Pendulum acceleration	Class 60
Thorax acceleration	Class 150
Femur-force	Class 600

The mountings for sensing devices shall have no resonance frequency within a range of 3 times the frequency range of the applicable channel class.

[§ 572.78 Performance test conditions.

(a) Conduct performance tests at any temperature from 66° F to 78° F, and at any relative humidity from 10 percent to 70 percent, but only after having first exposed the dummy to these conditions for a period of not less than 4 hours.

(b) For the performance tests specified in § 572.72 (head), § 572.74 (thorax), § 572.75 (lumbar spine, abdomen, and pelvis), and § 572.76 (limbs), position the dummy as set out in paragraph (c) of this section.

(c) Place the dummy on a horizontal seating surface covered by teflon sheeting so that the dummy's midsagittal plane is vertical and centered on the test surface.

(1) The seating surface is flat, rigid, clean, and dry, with a smoothness not exceeding 40 microinches, a length of at least 16 inches, and a width of at least 16 inches.

(2) For head impact tests, the seating surface has a vertical back support whose top is 12.4 ± 0.2 inches above the horizontal surface, and the rear surfaces of the dummy's back and buttocks touch the back support as shown in Figure 40.

(3) For the thorax, lumbar spine, and knee tests, the horizontal surface is without a back support as shown in Figure 41 (for the thorax), Figure 42 (for the lumbar spine), and Figure 43 (for the knee).

(4) Position the dummy's arms and legs so that their center lines are in planes parallel to the midsagittal plane.

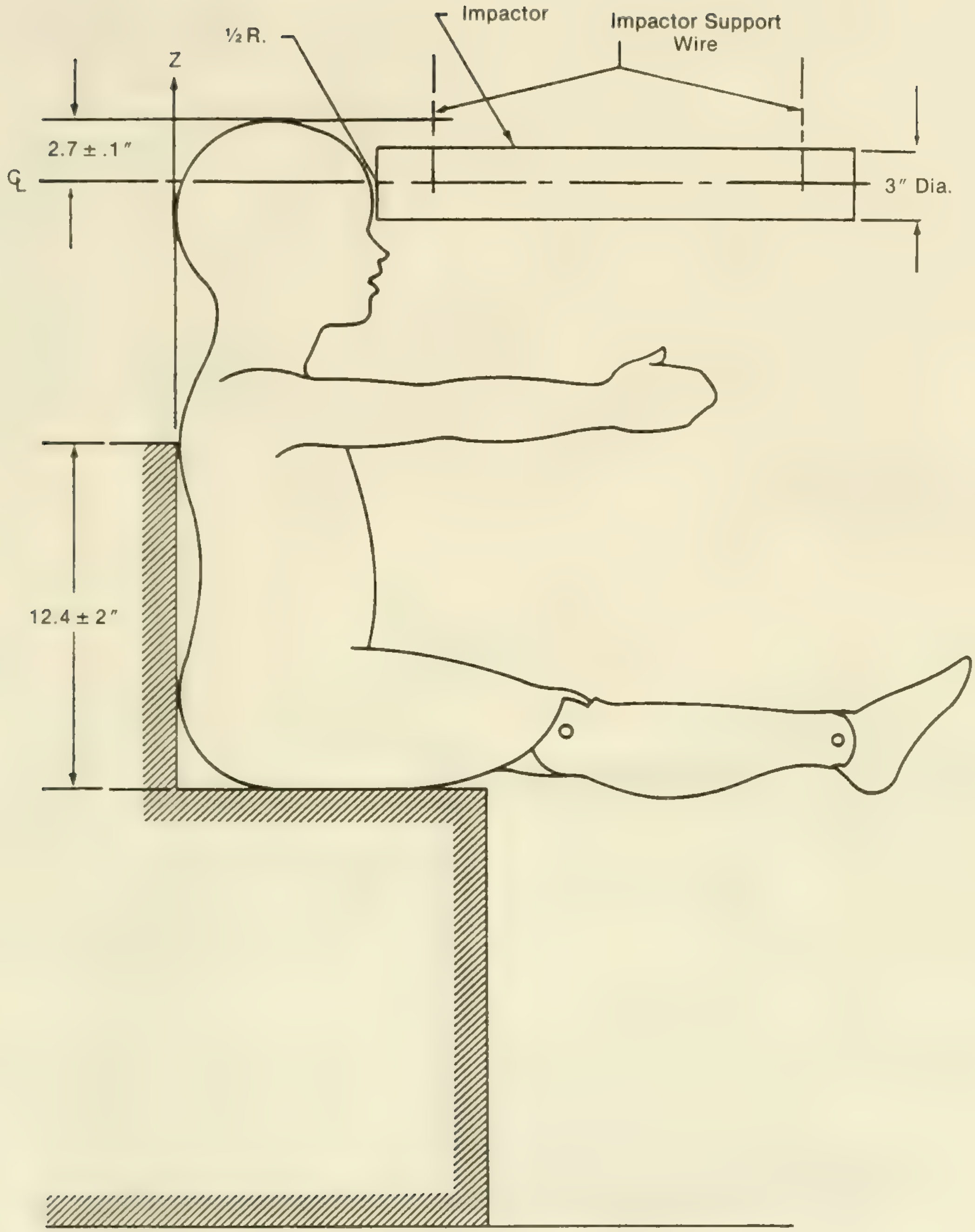
(5) Adjust each shoulder yoke so that with its upper surface horizontal, a yoke is at the midpoint of its anterior-posterior travel.

(6) Adjust the dummy for head and knee impact tests so that the rear surfaces of the shoulders and buttocks are tangent to a transverse vertical plane.

(d) The dummy's dimensions are specified in drawings SA 106C 001, sheets 3 through 6.

(e) Unless otherwise specified in this regulation, performance tests of the same component, segment, assembly or fully assembled dummy are separated in time by a period of not less than 20 minutes.

(f) Unless otherwise specified in this regulation, the surfaces of the dummy components are not painted. **(56 F.R. 57830—November 14, 1991. Effective: May 12, 1992)]**

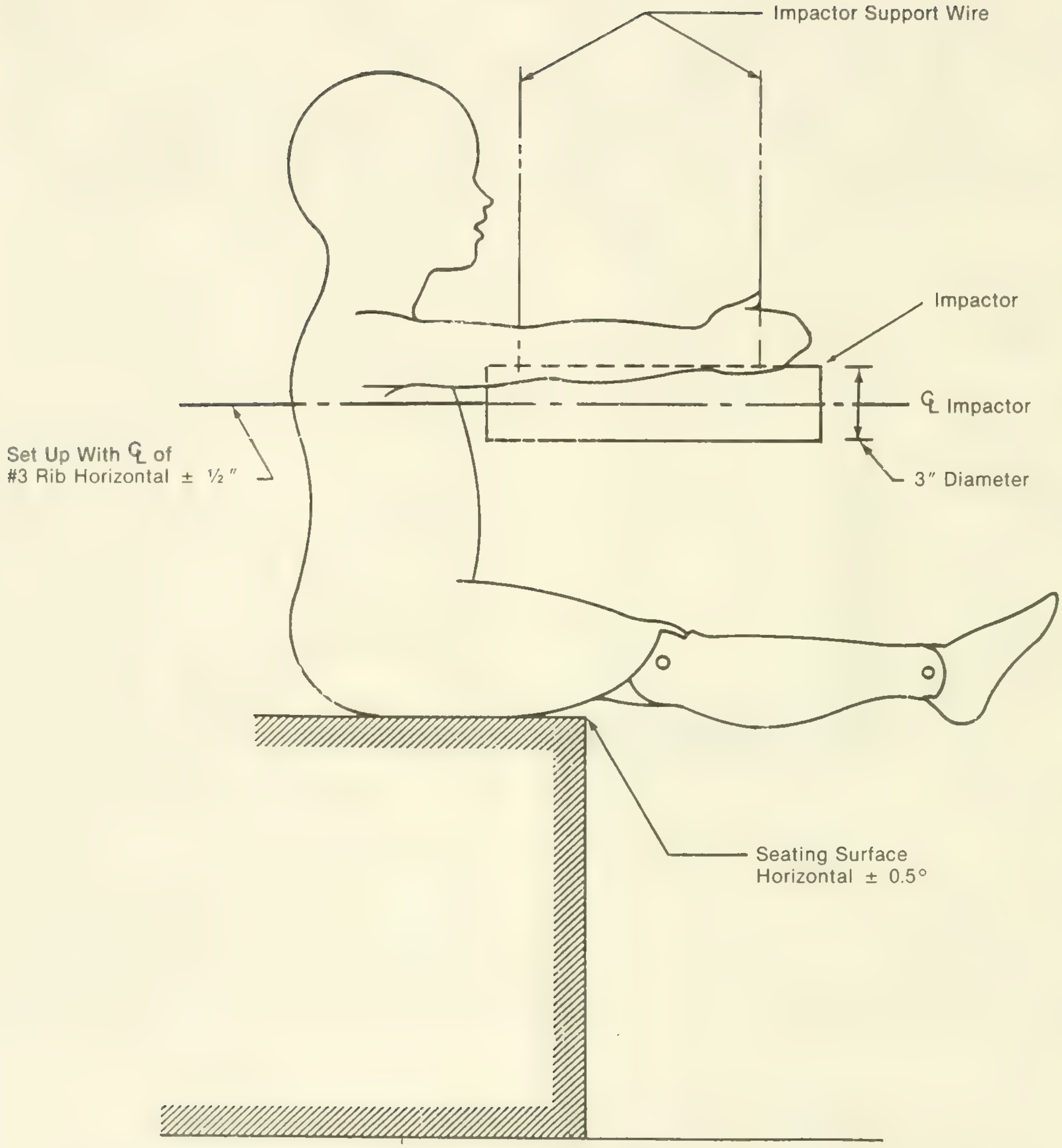


NOTES: 1. Dummy Impact Sensors not used in this test may be replaced by equivalent dead weights.

2. No External supports are required on the dummy to meet set-up specifications.

3. The Midsagittal Plane of the dummy is vertical within +/−1 degree.

4. The Midsagittal Plane of the head is centered with respect to the longitudinal centerline of the Pendulum within 0.12 inch.

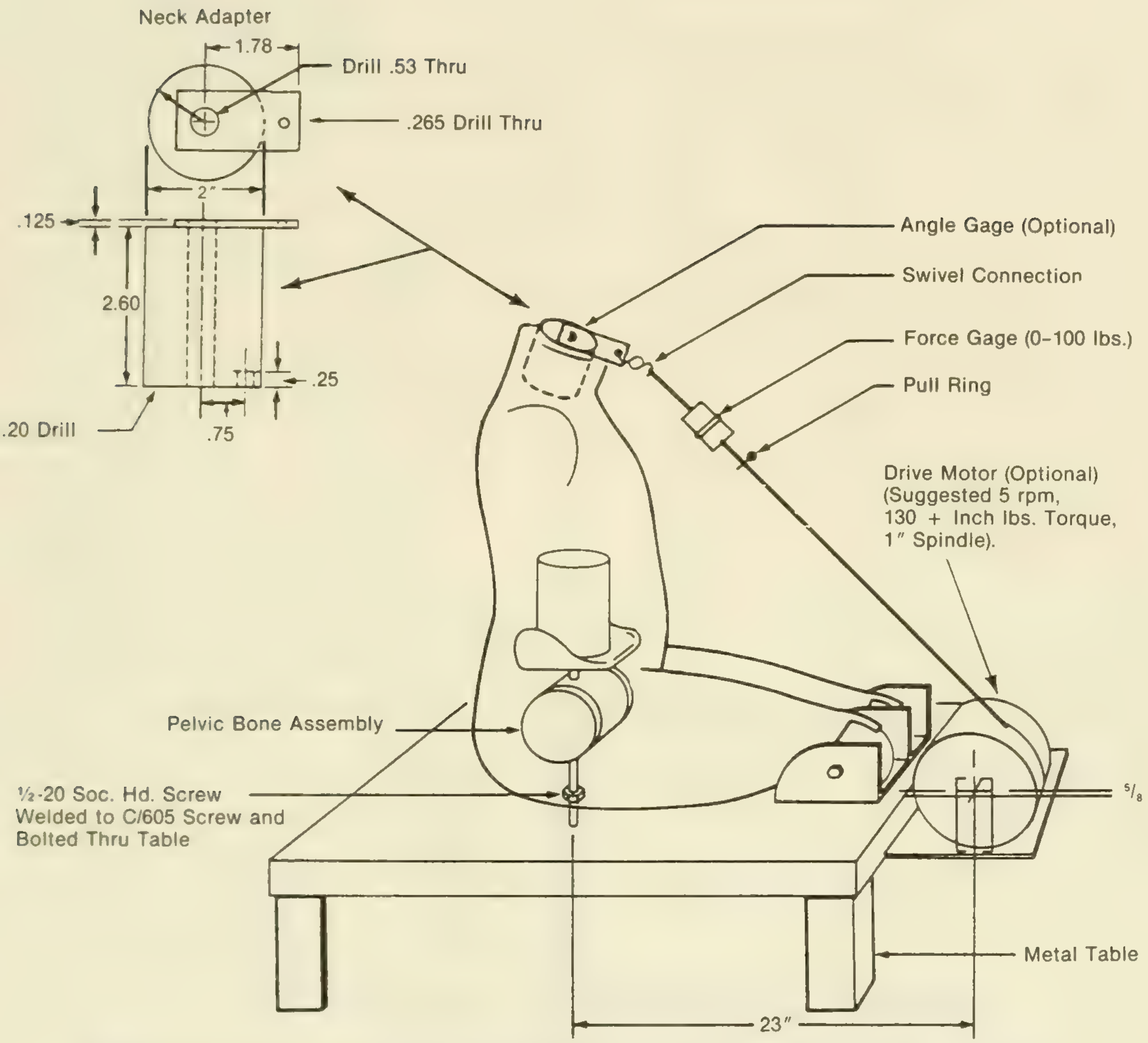


NOTES: 1. Dummy Impact Sensors not used in this test may be replaced by equivalent dead weights.

2. No External supports are required on the dummy to meet set-up specifications.

3. The Midsagittal Plane of the dummy is vertical within +/−1 degree.

4. The Midsagittal Plane of the Thorax is centered with respect to the longitudinal centerline of the Pendulum within 0.12 inch.



NOTES: 1. Dummy Impact Sensors not used in this test may be replaced by equivalent dead weights.

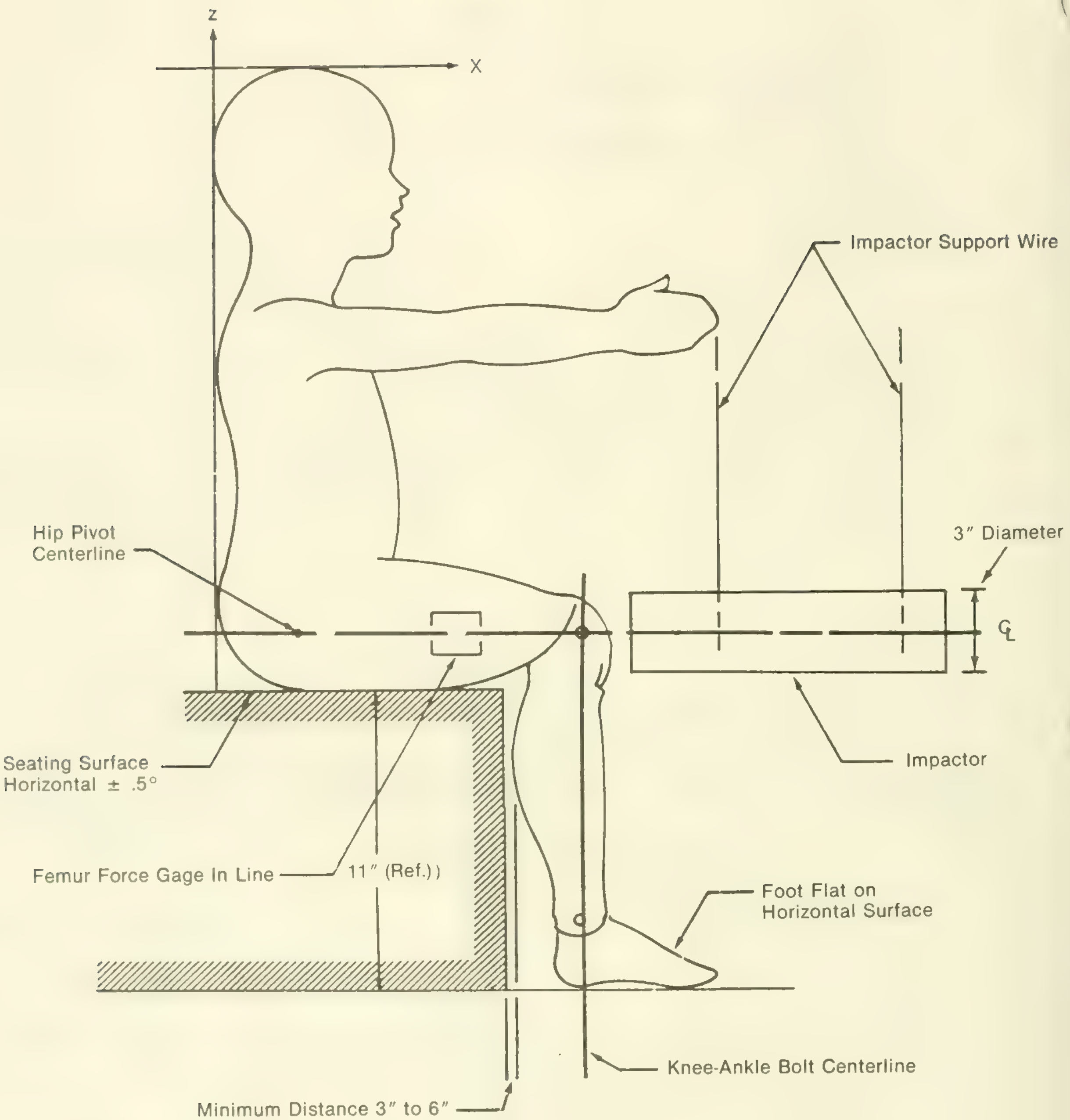
2. No External supports are required on the dummy to meet set-up specifications.

3. The Midsagittal Plane of the dummy is vertical within +/− degree.

4. The Dummy in the seated position is firmly affixed to the Test Bench at the Pelvic Bone and at the Knees.

5. The Pull-Flexion Force, applied through a rigid Neck Adaptor with is mounted on top of the Thoracic Sternum Assembly (C/601), is aligned with the Midsagittal Plane of the Dummy within +/−1 degree.

6. The Swivel for the Force Measuring Sensor must not bind or bottom out through the entire loading cycle.



NOTES: 1. Dummy Impact Sensors not used in this test may be replaced by equivalent dead weights.

2. No External supports are required on the dummy to meet set-up specifications.

3. The Midsagittal Plane of the dummy is vertical within +/− degree.

4. Centerline of the Impacted Femur is aligned with the centerline of the Impactor and the plane of the Impactor Motion within +/− 1 degree.

[Subpart J—9-Month-Old Child

[§ 572.80 Incorporated materials.

The drawings and specifications referred to in this regulation that are not set forth in full are hereby incorporated in this part by reference. These materials are thereby made part of this regulation. The Director of the Federal Register approved the materials incorporated by reference in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the materials may be obtained from Rowley-Scher Reprographics, Inc., 1216 K Street, N.W., Washington, D.C. 20002, (202) 628–6667. Copies are available for inspection in the general reference section of Docket 89–11, Docket Section, National Highway Traffic Safety Administration, Room 5109, 400 Seventh Street, S.W., Washington, D.C., or at the Office of the Federal Register, 1100 L Street, N.W., Room 8401, Washington, D.C.

[§ 572.81 General description.

(a) The dummy consists of:

(1) The assembly specified in drawing LP 1049/A, which is described in its entirety by means of approximately 54 separate drawings and specifications: 1049/1 through 1049/54;

(2) A parts list LP 1049/0 (5 sheets); and

(3) A report entitled, "The TNO P3/4 Child Dummy Users Manual," January 1979, published by Instituut voor Wegtransportmiddelen TNO.

(b) Adjacent dummy segments are joined in a manner such that throughout the range of motion and also under simulated crash-impact conditions there is no contact between metallic elements except for contacts that exist under static conditions.

(c) The structural properties of the dummy are such that the dummy conforms to this Part in every respect both before and after being used in dynamic tests such as that specified in Standard No. 213 of this Chapter (§ 571.213).

[§ 572.82 Head.

The head consists of the assembly shown in drawing LP 1049/A and conforms to each of the applicable drawings listed under LP 1049/0 through 54.

[§ 572.83 Head-Neck.

The head-neck assembly shown in drawing 1049/A consists of parts specified as items 1 through 16 and in item 56.

[§ 572.84 Thorax.

The thorax consists of the part of the torso shown in assembly drawing LP 1049/A and conforms to each of the applicable drawings listed under SP 1049/0 through 54.

[§ 572.85 Lumbar spine flexure.

(a) When subjected to continuously applied force in accordance with paragraph (b) of this section, the lumbar spine assembly shall flex by an amount that permits the thoracic spine to rotate from its initial position in accordance with Figure No. 18 of § 572.21 (49 CFR Part 572) by 40 degrees at a force level of not less than 18 pounds and not more than 22 pounds, and straighten upon removal of the force to within 5 degrees of its initial position.

(b) *Test procedure.*

(1) The lumbar spine flexure test is conducted on a dummy assembly as shown in drawing LP 1049/A, but with the arms (which consist of parts identified as items 17 through 30) and all headneck parts (identified as items 1 through 13 and 59 through 63) removed.

(2) With the torso assembled in an upright position, adjust the lumbar cable by tightening the adjustment nut for the lumbar vertebrae until the spring is compressed to ⅔ of its unloaded length.

(3) Position the dummy in an upright seated position on a seat as indicated in Figure 18 of § 572.21 (lower legs do not need to be removed, but must be clamped firmly to the seating surface), ensuring that all dummy component surfaces are clean, dry, and untreated unless otherwise specified.

(4) Firmly affix the dummy to the seating surface through the pelvis at the hip joints by suitable clamps that also prevent any relative motion with respect to the upper legs during the test in § 572.65(c)(3) of this Part. Install a pull attachment at the neck to torso juncture as shown in Figure 18 of § 572.21.

(5) Flex the thorax forward 50 degrees and then rearward as necessary to return it to its initial position.

(6) Apply a forward pull force in the midsagittal plane at the top of the neck adapter so that at 40 degrees of the lumbar spine flexion the applied force is perpendicular to the thoracic spine box. Apply the force at any torso deflection rate between 0.5 and 1.5 degrees per second up to 40 degrees of flexion but no further; maintain 40 degrees of flexion for 10 seconds, and record the highest applied force during that time. Release all force as rapidly as possible and measure the return angle 3 minutes after release.

[§ 572.86 Test conditions and dummy adjustment.

(a) With the complete torso on its back lying on a horizontal surface and the neck assembly mounted and shoulders on the edge of the surface, adjust the neck such that the head bolt is lowered 0.40 ± 0.05 inches (10 ± 1 mm) after a vertically applied load of 11.25 pounds (50 N) applied to the head bolt is released.

(b) With the complete torso on its back with the adjusted neck assembly as specified in § 572.66(a), and lying on a horizontal surface with the shoulders on the edge of the surface, mount the head and tighten the head bolt and nut firmly, with the head in horizontal position. Adjust the head joint at the force between 1–2g, which just supports the head's weight.

(c) Using the procedures described below, limb joints are set at the force between 1–2g, which just supports the limbs' weight when the limbs are extended horizontally forward:

(1) With the complete torso lying with its front down on a horizontal surface, with the hip joint just over the edge of the surface, mount the upper leg and tighten hip joint nut firmly. Adjust the hip joint by releasing the hip joint nut until the upper leg just starts moving.

(2) With the complete torso and upper leg lying with its front up on a horizontal surface, with the knee joint just over the edge of the surface, mount the lower leg and tighten knee joint firmly. Adjust the knee joint by releasing the knee joint nut until the lower leg just starts moving.

(3) With the torso in an upright position, mount the upper arm and tighten firmly the adjustment bolts for the shoulder joint with the upper arm placed in a horizontal position. Adjust the shoulder joint by releasing the shoulder joint nut until the upper arm just starts moving.

(4) With the complete torso in an upright position and upper arm in a vertical position, mount the forearm in a horizontal position and tighten the elbow hinge bolt and nut firmly. Adjust the elbow joint nut until the forearm just starts moving.

(d) With the torso assembled in an upright position, the adjustment nut for the lumbar vertebrae is tightened until the spring is compressed to ⅔ of its unloaded length.

(e) Performance tests are conducted at any temperature from 66° to 78° F and at any relative humidity from 10 percent to 70 percent after exposure of the dummy to these conditions for a period of not less than four hours.

(f) Performance tests of the same component, segment, assembly, or fully assembled dummy are separated in time by a period of not less than 20 minutes unless otherwise specified.

(g) Surfaces of the dummy components are not painted except as specified in the part or in drawings incorporated by this part. **(56 F.R. 41077—August 19, 1991. Effective: February 15, 1992)**

38 F.R. 20499
August 1, 1973